Rock Products

$2.00 A YEAR | CHICAGO | DECEMBER 20, 1919

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PERFORATED METAL SCREENS

MEET EVERY REQUIREMENT

Elevator Buckets

General Sheet and Light Structural Work

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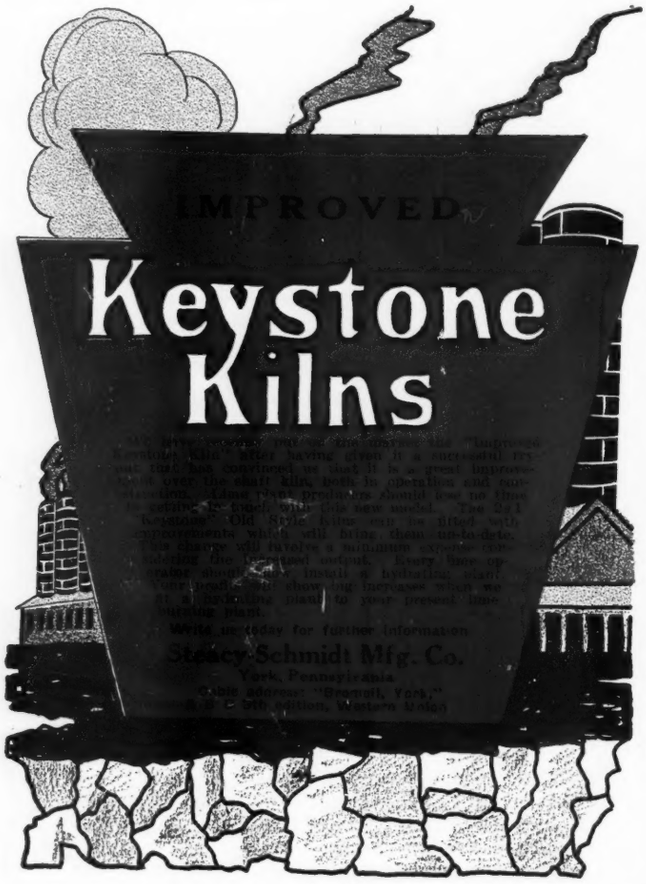
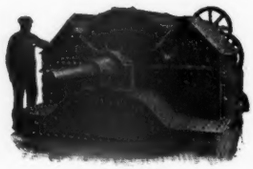


"PENNSYLVANIA"
Hammer Crushers



For Crushing and Pulverizing Lime, Limestone, Gypsum, Marl, Shale, Etc. Main Frame of Steel, "Ball and Socket" Self Aligning Bearings; forged Steel Shaft; Steel Wear Liners; Cage adjustable by hand wheel while Crusher is running. No other hammer Crusher has such a big Safety Factor.

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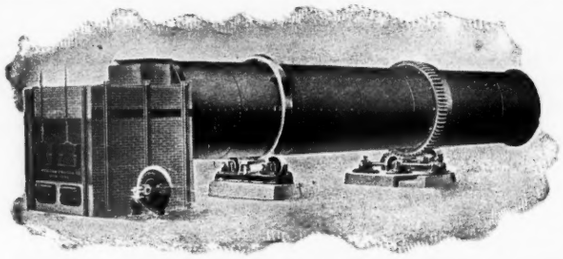
Pennsylvania Crusher Company
New York PHILADELPHIA Pittsburgh



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AMERICAN PROCESS CO. 68 Williams Street NEW YORK CITY

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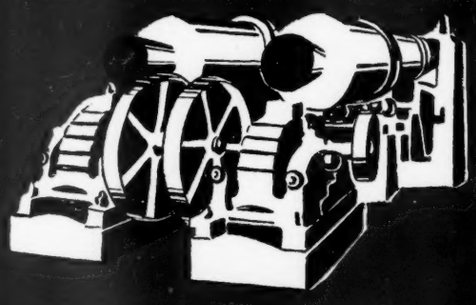
Cement Manufacturers and Supply Dealers

Some of our customers who are using our Puncture and Waterproof bags report one-third increased sales to their satisfied customers. Also report breakage for 1917 and 1918 from all causes only one-half of one per cent.

THE JAITE CO.
JAITE, OHIO
Sole Manufacturers



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DOUBLE — STITCHED
CONVEYOR and ELEVATOR
BELTING

Wears Longer—More Economical

IMPERIAL BELTING COMPANY
Lincoln and Kinzie Streets, Chicago

The Season's Greetings

Again comes Christmas—
That season of
Good Cheer
And kind reminder
Of the many favors
And friendly co-operation
That you—
Our customers and friends
Around the world—
Have evidenced
Toward us
Throughout the year.

So now
We Traylor people—
From Apprentice Lad
To Manager—
From Office Boy
To Chairman—
All join
In expressing
Our deep appreciation
And in wishing you
One and all
A Merry Christmas
And A Happy
And Most Prosperous
New Year.

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Pittsburgh 211 Fulton Bldg.
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Spokane Mohawk Block

Rock Products

TRADEPRESS PUBLISHING CORPORATION
542 SOUTH DEARBORN STREET
CHICAGO

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Entered as second class matter July 2, 1907, at the Postoffice at Chicago; under act of March 3, 1879.

JUST A SQUINT AT A No. 8 TELSMITH BREAKER

This No. 8 gyratory breaker is operating in the Cedar Hollow plant of the Charles Warner Co., Wilmington, Del. It has been in service since early in 1918, crushing limestone from a ¾-yard steam shovel. The capacity of the breaker, set to 2½" discharge, is 150 cu. yds. hourly—considerably more than its rated capacity. The actual power consumption is 35-38 H. P. The machine has been re-babbitted once since it started. It does its work easily, finishing the day with all bolts tight and the oil only blood warm.

The massive structure of this machine is not apparent in the photograph, but these figures will give some idea of its tremendous strength: Height from sills to rim of crown, 5′ 4¾″; weight of breaker complete, 56,000 lbs.; diameter of middle rib, 6′ 6¾″; size of each feed opening, 18″ x 75″; size of crushing cone (height by top diameter by bottom diameter), 2′ 8⅞″ x 2′ 0″ x 3′ 7″; size of crushing bowl (vertical height by top diameter by bottom diameter), 2′ 5⅜″ x 5′ ¼″ x 3′ 11″; size of central shaft (main diameter by length between supports), 13½″ x 4′ 9¼″.

If you divide the weight of this machine by its height in inches, you'll find that it is the heaviest metalled machine on the market—bar none. We will be very glad to have the privilege of sending you our Catalog No. 166 (Telsmith Primary Breakers) and our Bulletin No. 2-F-11 (Telsmith Reduction Crushers). Send us your address and we will mail them without obligation.

SMITH ENGINEERING WORKS

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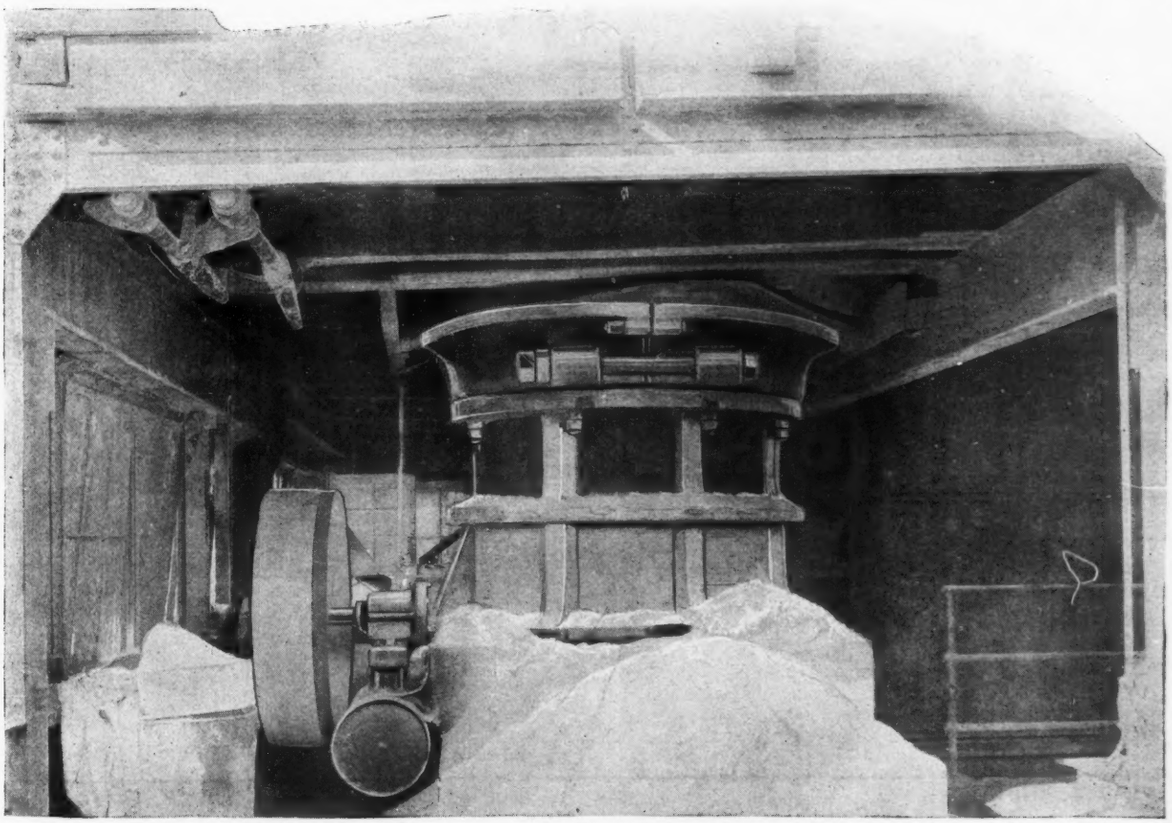

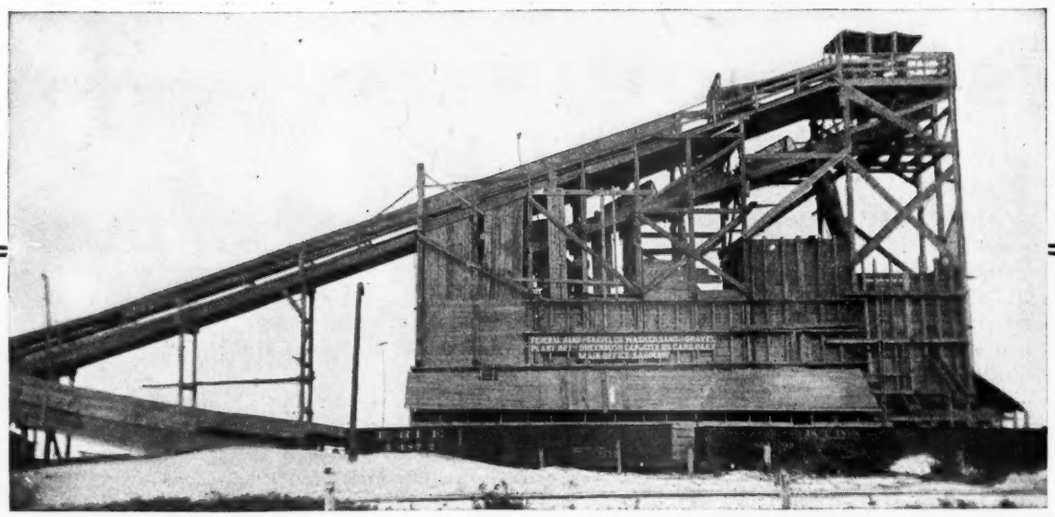

Rebuild Your Old Plant and Get Increased Capacity

WE are now redesigning many small plants—increasing the output and general efficiency, and getting a better product. The illustrations show the Greenbush plant of the Federal Sand & Gravel Co., at Saginaw, Mich. The original plant (lower illustration) was built in 1911.

New additions recently completed—enlarged bin capacity and the installation of improved inclined conical screens—have increased the capacity of the plant approximately 50%. The new plant is shown in the upper illustration.

Let our experienced engineers look over your present plant. No doubt they can suggest a plan that will give YOU greater capacity.

Be prepared to get your share of the big volume of business which is sure to come next spring.

Get in touch with us today.

LINK-BELT COMPANY

489

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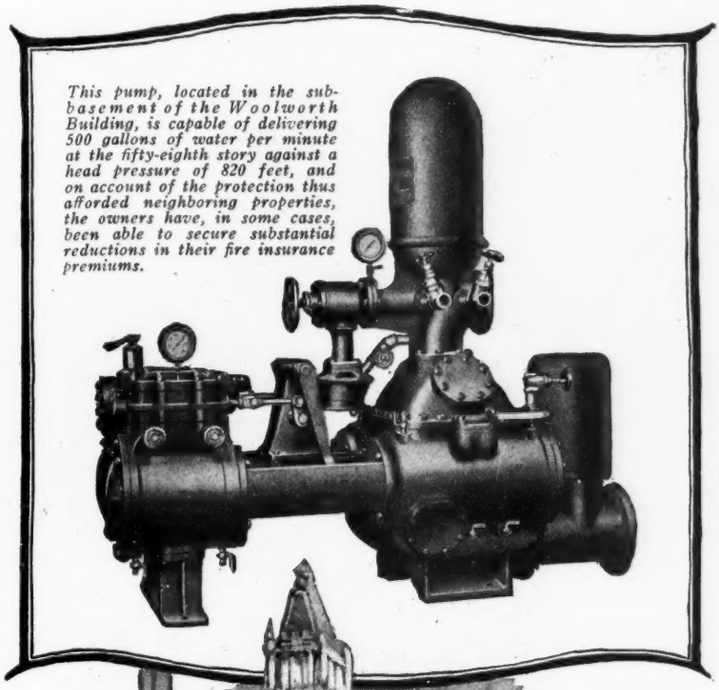

This pump, located in the sub-basement of the Woolworth Building, is capable of delivering 500 gallons of water per minute at the fifty-eighth story against a head pressure of 820 feet, and on account of the protection thus afforded neighboring properties, the owners have, in some cases, been able to secure substantial reductions in their fire insurance premiums.

When the world's highest building is in danger—Worthington Pumps protect it

More than 700 feet above the street, yet the fifty-eighth floor is as fire-safe as the first.

The Woolworth Building, the Metropolitan Tower, the Municipal Building—engineering achievements of world-wide fame—all depend on Worthington equipment for both fire protection and general service.

It is a significant fact that throughout New York, where property values demand the most infallible protection, and where conditions of service are most severe, there is a decided preference for Worthington equipment.

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Every Shot a Success

FOR many years Quarrymen have associated the word "Aetna" with the idea of a successful shot. You can rely on Aetna Explosives to produce the results they are intended to produce. They are dependable—always—because they are always uniform, always up to standard.

By employing the power of Aetna Explosives you compel every dollar invested in time and labor to yield a maximum return.

A scientific study of the many problems presented by varying rock conditions has resulted in the perfection of different grades of Aetna Explosives, each designed for a specific use.

The Aetna Service Department will be glad to assist you in analyzing your problems gratis. A letter brings our representative, a blasting specialist, promptly to the scene of operations.

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AETNA **It does the work!**

You will get entire satisfaction if you mention ROCK PRODUCTS

Cuts Haulage Cost 50%

is what users say of the Plymout Gasoline Locomotive.

The following statements are quoted from information recently sent us by industrial contractors—and the letters are on file in our office.

From Waterloo, Ia. Bryant Paving Co.—Street Paving and Road Building.

"Needed power. This one seemed best adapted to work of anything we had seen."

This firm is now using 3 locomotives.

From Augusta, Georgia. A. J. Twiggs & Sons—Engineers and Contractors, regarding haulage cost—

"From 5c to 8c per ton. Formerly it was about 25c a ton—we can handle about 200 tons a day."

From New York City. J. F. Cogan Company—General Contractors. This firm bought first locomotive 2 years ago. They now are using 5, and they say—

"After the trial of the first, we saw it was a good thing."

That the first locomotive made good, is evidenced by the later purchase of 4 additional locomotives.

From New Jersey. Black & Klockner—Road Building and General Contracting.

"The haulage capacity and the speed in which it did the work.

"We are using cars and engines to cross and fill lakes and bogs, where it would be impossible for anything to go into other than going through the air." This firm at present uses 2 locomotives.

What is Your Haulage Problem?

Write to us. Perhaps we can help you solve it. Our engineers will tell you if the Plymouth Gasoline Locomotive is a worthy investment.

Send for our illustrated catalog. It shows many phases of haulage—underground and surface. This locomotive works anywhere tracks can be laid.

Get the facts about this efficient locomotive. It cuts the haulage cost by increasing tonnage.

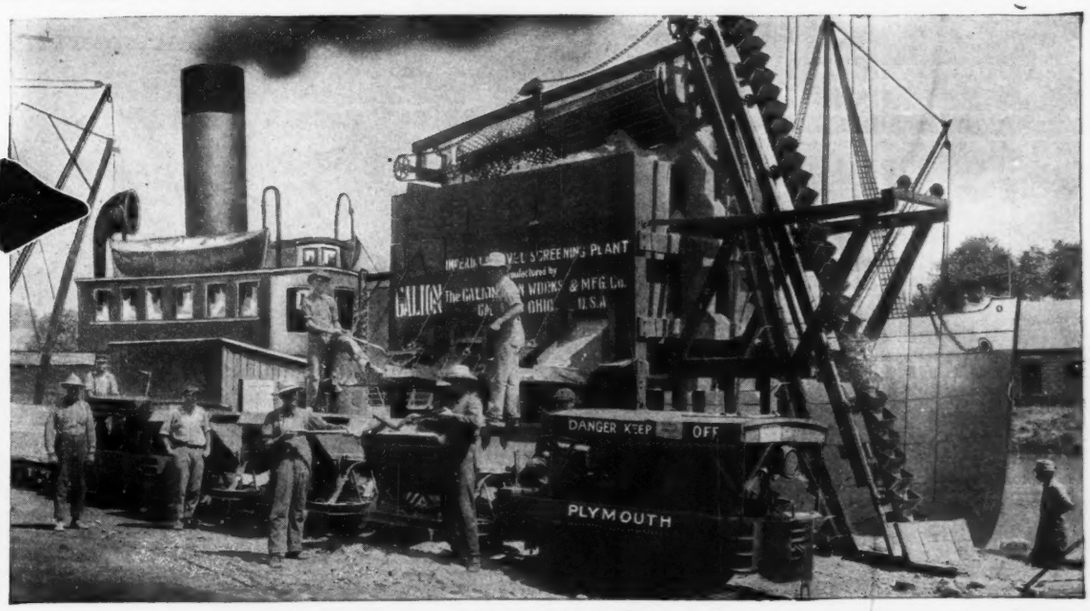
Fewest Repairs Necessary

It is built to stand hard, 24-hour-day work. Friction drive—Bosch Ignition—Continental high-powered motor—One-piece frame casting reduces vibration and keeps bearings and other parts properly aligned.

THE FATE-ROOT-HEATH COMPANY

Successors to The J. D. Fate Co.

210 Riggs Avenue **PLYMOUTH, OHIO**



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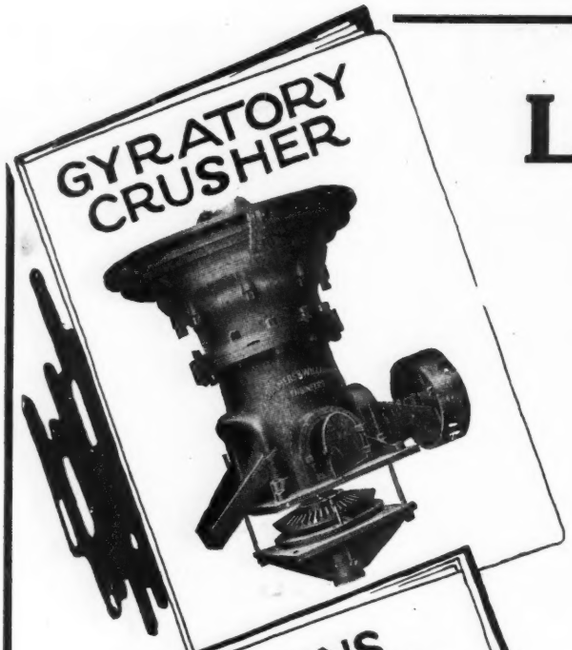

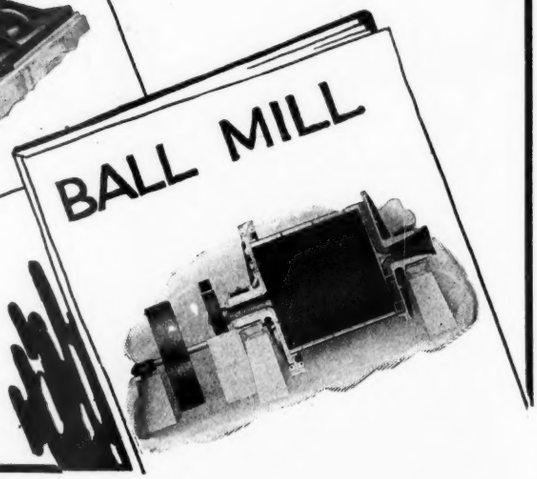

Let Us Send You These Catalogues

We would like to have you in this way acquaint yourself with the superior quality of our product; learn just what the machines will accomplish on your product.

If you have not already investigated their advantages, we believe it would be to your advantage to consider our reduction machinery.

CHALMERS
and
WILLIAMS
1425 Arnold St.
Chicago Heights, Ill.

Our Other Products

Jaw Crushers
Tube Mills
Stamp Mills
Crushing Rolls
Pulsating Screens
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BALDWIN SERVICE

These two words, known all over the world, mean more than simply *building locomotives.* Prior to the designing of a locomotive—whether for a railway company, industrial establishment or contractor—our engineering skill and experience in building more than 52,000 locomotives is at the command of the customer.

After the delivery of the locomotive, we are always prepared to furnish on short notice any duplicate or spare parts needed for maintenance.

Baldwin Service is Perpetual

Some time ago, for example, we furnished a set of links and eccentric rods for a Baldwin Industrial Locomotive built in 1867. Our complete records made prompt shipment a simple task.

Baldwin Locomotives are in use throughout the world and are built to stand the hardest kind of work.

Let us quote on your requirements

The Baldwin Locomotive Works

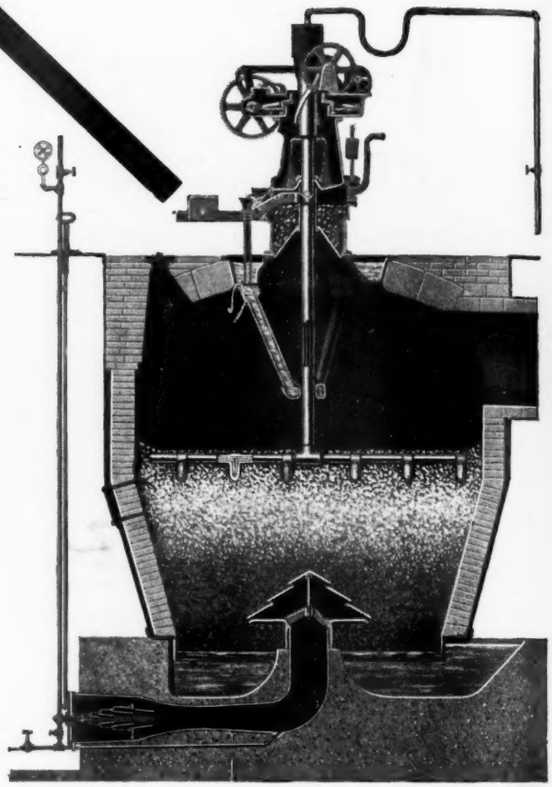
PHILADELPHIA, PA.

It gets immediate attention if you mention ROCK PRODUCTS

Make Your Kilns Produce More Lime

Lime manufacturers realize that they are facing an unprecedented demand for their product. All indications point toward a gigantic construction program for the coming year—a construction program which can not be carried out unless lime manufacturers produce more lime.

Several of the larger manufacturers have already increased their output by installing



Chapman Floating Agitators

on their hand-poked Gas Producers. They find the capacity of their producers is doubled, and that a constant quantity and quality of gas is delivered to the kilns. Every practical lime man knows that the uniform temperature thus made possible, means a greater production of lime.

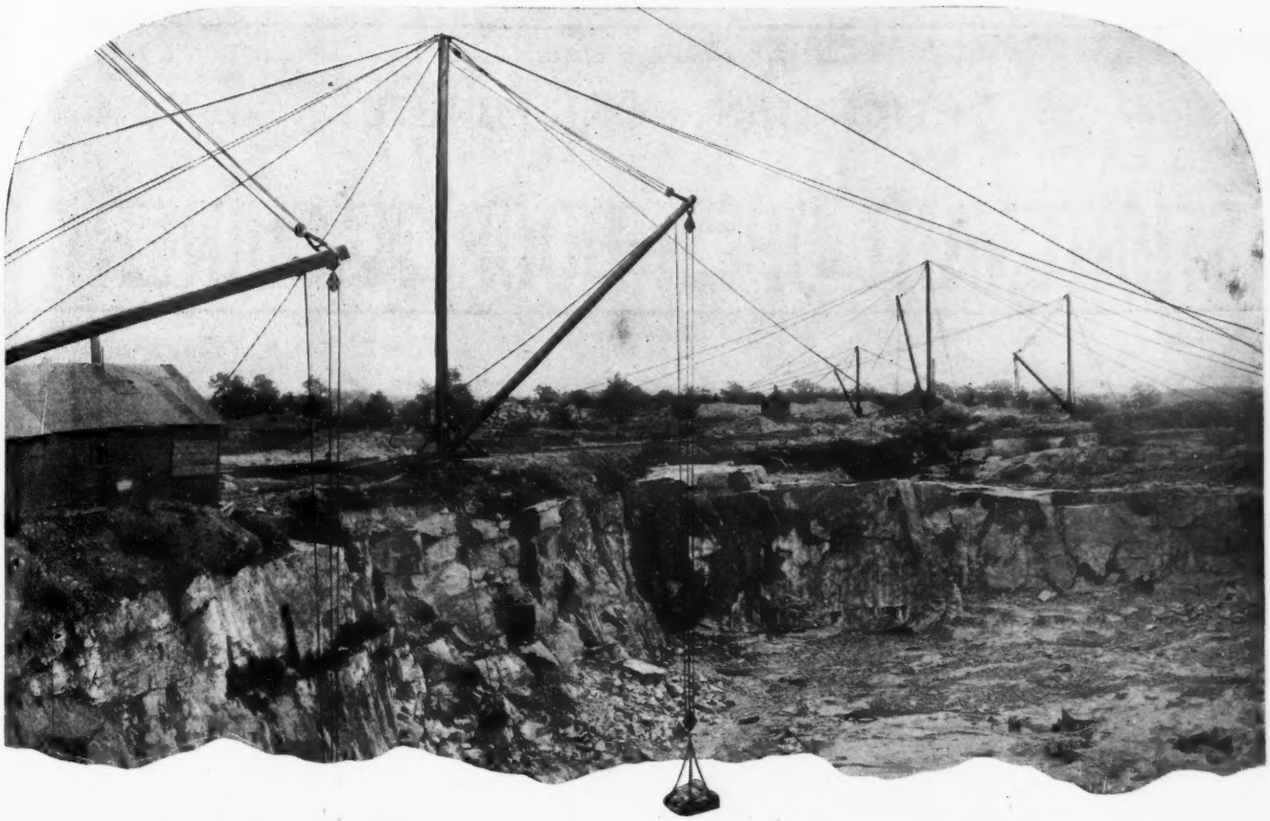
We are also prepared to handle complete Gas Producer installations. Our force of experienced engineers are glad to give the lime producer any information on the application of producer gas.

Let us solve your fuel problems

CHAPMAN ENGINEERING CO.

MT. VERNON, OHIO

11 Broadway, New York **Oliver Bldg., Pittsburgh, Pa.**



Nine hoists in every ten are "Americans"

PREVIOUS to 1891 the large granite rocks quarried in the famous St. Cloud, Minnesota, district were handled by horse power hoists.

During that year Tom Breen, then a prominent quarryman of the Northwest, purchased the district's first steam operated hoist. It carried the "American" name plate.

Today—twenty-eight years later—that same "American" Hoist is still in service. There are now twenty quarries in the district. Ninety per cent of all the hoists and derricks in this district are "Americans."

No more eloquent expression of appreciation for "American" quality, design and service could be desired. You, too, will share that appreciation after your first "American" Hoist has been placed in service.

No matter what your requirements may be, there's an "American" to meet your needs.

No matter where you are, an "American" representative can reach you in twenty-four hours.

American Hoist & Derrick Co.

Saint Paul Minnesota

New York Chicago Seattle Pittsburgh New Orleans Detroit

AMERICAN

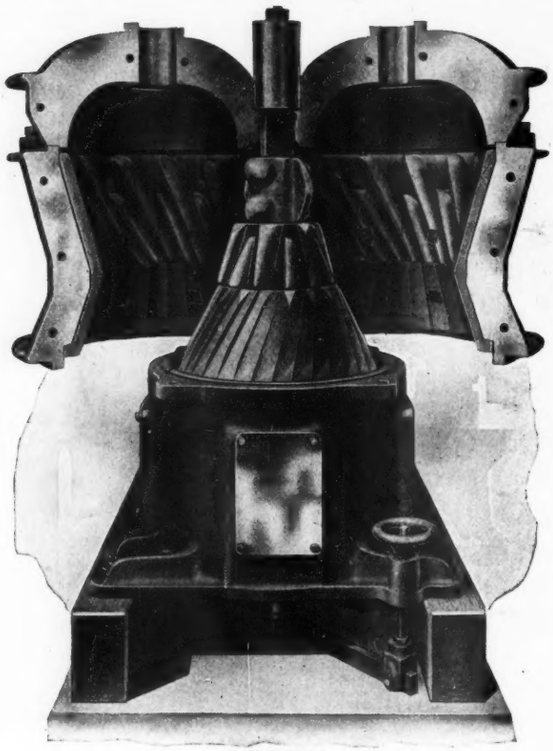
HOIST & DERRICK CO.

Cooperation is the thing—please mention ROCK PRODUCTS

"ONE MAN – ONE MINUTE"

STURTEVANT "OPEN-DOOR" MACHINERY

"Open-Door" Rotary Fine Crusher



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FOR THE REDUCTION OF SOFT AND MODERATELY HARD MATERIALS FROM LARGE PIECES TO 1/2 AND 1/4 INCHES

Unfasten the bolts, throw open the door and get at all wearing parts. One man can open the door in a very few minutes.

SHUT-DOWNS ARE COSTLY—TIME IS MONEY

"Open-Door" machinery pays because it operates more continuously than any other, therefore production is greater and less time and labor are necessary in case of obstruction or repairs.

BUILT IN FIVE SIZES

Send for Catalogs of Sturtevant "Open-Door" Machines for Crushing, Grinding, Screening, Elevating, Conveying, Weighing and Mixing

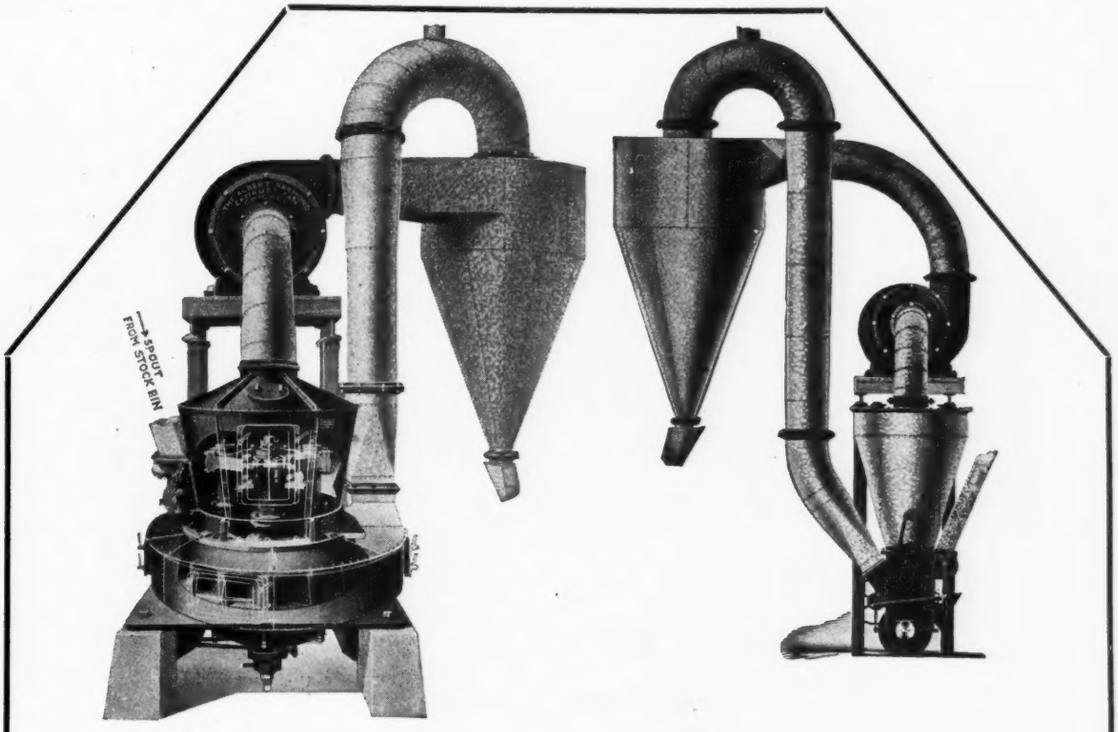
STURTEVANT MILL CO., BOSTON MASS.

HARRISON SQUARE

For better service say, "I saw it in ROCK PRODUCTS"

RAYMOND
PULVERIZING
AIR-SEPARATING
SYSTEM
CHICAGO-U.S.A.

RAYMOND
PULVERIZING
AIR-SEPARATING
SYSTEM
CHICAGO-U.S.A.



A remark made by one of our customers manufacturing Hydrated Lime emphasizes more clearly than anything we can say, the economy in using Raymond Air-Separating equipment instead of screens.

"Our neighbor uses screens for his hydrate. Outside his plant there is a waste lime pile of many hundred tons containing not only impurities but a high percentage of good Hydrate which he could have saved had he the same equipment as ours."

The Raymond Air-Separating System performs three distinct operations and gives a finished product which does not blister in wall plaster.

The Hydrate is fed to the System by an automatic feed arrangement, which feeds a constant amount, and prevents flooding.

The beaters in the grinding chamber of the mill are operated at a low speed to merely knock the good Hydrate free of the impurities like core, sand and unburnt lime. These impurities being discharged through an automatic throw-out attachment.

The good Hydrate is carried up into the air-separator, where large particles which are not fine enough are returned for further reduction and the finished uniform material is carried direct to a storage bin, from which it is bagged.

An investigation will bear out all these statements and show you where a great saving can be obtained.

RAYMOND BROS. IMPACT PULVERIZER CO.

Western Office:
201 Boston Bldg., Denver, Colo.

1301 North Branch St., Chicago, Ill.

The advertiser wants to know that you saw his ad in ROCK PRODUCTS

Complete Rock Crushing Plants

THEIR DESIGN AND CONSTRUCTION for Uninterrupted Operation and Most Economical Production of CRUSHED ROCK

have been the subject of special study by Allis-Chalmers Engineers for many years. Their eminent success in this field is vouched for by the following letter written by one of our customers:

ROSENBERGER, ECKLES & THORNBURGH,
Wichita Falls, Texas.

Gentlemen: *Attention Mr. Thornburgh.*

We have your favor of the 13th inst. in regard to your proposed installation of a large rock crushing plant at Wichita Falls.

Our experience with crusher people has led us to consider the Allis-Chalmers Manufacturing Company of Milwaukee, Wis., the most reliable crusher concern in the Country. We would suggest that you write ..... of the Allis-Chalmers Company, care of the Peoples Gas Building, Chicago, Ill., and explain to him just what you want in the way of a crushing plant. He will do the rest; he will tell you just what you need in the way of a plant and what it will cost you. If we were building a plant today we would turn the matter over to ..... and the Allis-Chalmers engineers and forget about it until they turned the plant over to us finished.

In regard to the cost of crushing rock. This depends entirely upon the kind of a plant that is installed, the nature of the quarry that is to be operated, the market for the stone and the service that the railroad gives. If you have a quarry and a plant that can be operated economically, a large market for your stone and at a good price, and the railroad company gives you good service, you will be surprised at the low cost per ton. On the other hand, if your plant is a failure or your quarry is expensive to operate, or if your market is slow and irregular, or if the railroad service is irregular, you will find that the cost per ton will run very high.

We suggest that you immediately take this matter up with the Allis-Chalmers people. They can advise you of the cost of the plant and after going into the matter from all angles, can give you an approximate crushing cost.

If we can be of further service to you in this matter, advise us.

Yours very truly,
GREENVILLE STONE & GRAVEL COMPANY,
LTM-n *L. T. McCourt, Secretary.*

ALLIS-CHALMERS ENGINEERS ARE AT YOUR SERVICE TO SOLVE YOUR CRUSHING PLANT PROBLEMS

ALLIS-CHALMERS

MILWAUKEE, WIS. U. S. A.

You will get entire satisfaction if you mention ROCK PRODUCTS

1919

Rock Products

Vol. XXII Chicago, December 20, 1919 No. 26

Fighting for Reasonable Freight Rates

THE INTERSTATE COMMERCE COMMISSION is constituted and functions much like a law court. Precedents are powerful factors in determining the character of its rulings. The Commission can not reverse itself without good reason.

Within the last few weeks the Interstate Commerce Commission has decided a case involving the reasonableness of a freight rate on crushed stone. This case is referred to by the Commission as unusual and exceptional. In some respects it is; in others it is identical with the cases of several hundred, possibly thousands of producers of mineral aggregates.

Some Exceptional Features

The case is exceptional in that the stone producer furnished the cars and did the switching at both ends of the haul. The case was exceptional in that it was fought and financed by a rich and powerful quarry operator of national reputation and prestige. The case was exceptional in that the Secretary of Commerce of the United States felt called upon to uphold the contentions of the quarry operator as a matter of public policy; and the case was unusual in that the quarry operator was able to obtain as a witness the former assistant general freight agent of the railway.

The fact that the quarry operator furnished the cars is not of vital or peculiar importance. A reduction of 5 cents per ton was made by the railway on this account in the original contract, which was specifically understood to be allowed in lieu of the interest and depreciation on an investment of $100,000 in equipment, whose estimated life was ten years. As a matter of fact, the value of the equipment used was less than $70,000.

The fact that the stone producer did the switching at both ends is not of vital or peculiar importance. Many quarry operators do their own switching at the quarry end, and in several instances where the shipments are made to cement, lime or chemical plants the consignee does his own switching.

In the particular case in question the facts that the stone producer furnished the cars and did the switching are important only in that it made the estimation of the railway costs so much the easier for the stone producer to arrive at. In a thousand and one other cases the argument could be carried out on identical lines, including in the estimated cost of the traffic an allowance for use of rolling stock and the switching.

Some Universal Features

The case is practically identical with that of all other crushed-stone producers in that the freight rates which were originally contracted for with the railways have been raised beyond all reason and out of all proportion to the cost of this low-grade traffic to the railways. The case is identical with a great many others in that the quarry operator was induced to make his original investment by a freight-rate understanding with the railway company.

A Far-Reaching Precedent

The quarry operator won a reduction in his present freight rates because it was proved that the railway derived a far greater income per ton mile from this traffic than it did from the average of all its other business. And the Commission decided that the need of income by the railways of the country as a whole is no justification for excessive rates on the commodity in question and no justification for holding up an individual shipper.

Whatever disposal may be made of the railway problem by the President or Congress, some semi-judicial body, or several of them, will undoubtedly be given authority to pass on the reasonableness of freight rates. Two methods are open to producers of mineral aggregates to profit by the decision in the case cited above. One is to take their thousand and one individual cases before these rate-making bodies, and the other is to compile all these cases into a single argument and try to get a decision sufficiently comprehensive to define the status of mineral aggregates in rate schedules.

The first method is probably the surest, but would be extremely costly to the individual producers, and would be a long drawn-out process at best. The second method would be by far the most helpful to the industry and would make it possible to enlist the active assistance of public highway authorities, just as the Secretary of Commerce was induced to give his aid in this particular case. Either method involves an immense amount of careful work in the compilation of traffic cost data, etc., and its final presentation.

Wisconsin Road Builders to Co-operate

Innovation in Expediting Road-Building Program

By R. W. Scherer

THE WISCONSIN HIGHWAY COMMISSION called contractors, highway builders, material dealers and machinery men into a conference lasting two days, December 3 and 4, at the State capital, to discuss ways and means of carrying out the vast road building program that has been mapped out for Wisconsin. Altogether, the sessions were conducted in the broad spirit of co-operation, on the principle that all interested parties had a huge problem to solve in common, and they went far to eradicate the feeling that engineers and contractors are enemies. Three hundred people, contractors large and small, practically all of the crushed stone, sand and gravel producers, the State Highway engineers and many machinery and cement salesmen were in constant attendance, and a vast amount of good is sure to result from the meeting.

A. R. Hirst, chief engineer of the Wisconsin Highway Commission, who already has many radical reforms in the road-building business to his credit, was the instigator of the conference and presided at the meetings. He announced that during the past season 140 miles of concrete road besides macadam and gravel roads had been built in the State, and that for Federal and State aid work alone 500 miles of concrete pavement had been planned for next year. County bond issues awaiting decision in this month's elections aggregate $84,000,000, and work resulting from these issues would be added to this mileage.

The 140 miles of road construction this season having caused an acute shortage of materials and transportation facilities, it was suggested that all interested parties put forth their best efforts to expedite an undertaking so essential to public welfare as road building, to accomplish a program in 1920 three times as great as 1919.

To Get Aggregates Through the Winter

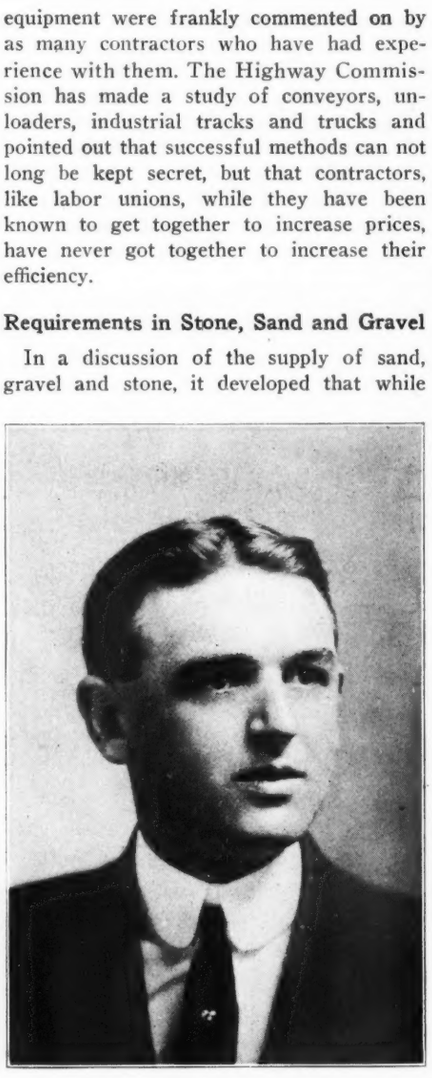
The two largest steps toward gaining this end are the determination of the highway commission to let contracts early in the season and to accumulate materials at the road sides and stations during the winter months. Thus 70 miles of concrete will have been awarded by January 15.

Crushed stone and sand will be shipped as soon and whenever railroad transportation permits; even the storage of cement was considered. Aggregates shipped during the winter months will be immediately carted to the road side and storage places at stations and sidings will be reserved for the movement through April and May, when it is impossible to get on the subgrade

Road-building methods were thoroughly discussed and a dozen different pieces of equipment were frankly commented on by as many contractors who have had experience with them. The Highway Commission has made a study of conveyors, unloaders, industrial tracks and trucks and pointed out that successful methods can not long be kept secret, but that contractors, like labor unions, while they have been known to get together to increase prices, have never got together to increase their efficiency.

Requirements in Stone, Sand and Gravel

In a discussion of the supply of sand, gravel and stone, it developed that while road work, exclusive of other demands, would require 2,000,000 tons of material, the total capacity of commercial plants, if distributed over a season of 200 days, is over 8,000,000 tons. Where, in spite of this surplus capacity, road-side crushers would be needed on account of high transportation costs, Mr. Hirst invited the co-operation of commercial producers to erect such plants, and it is confidently expected that this suggestion will lead to definite arrangements along this line.



A. R. Hirst, state highway engineer of Wisconsin

The labor situation received attention and Mr. Hirst announced that it was not the policy of the commission to award contracts based on an exorbitant scale of wages, above the prevailing wages in the particular community, as to do so would make roads cost many times the contract price in wages increased in other industries in that community.

To further stimulate the movement of material and to enable contractors to anticipate their wants, Mr. Hirst announced that in future estimates will be allowed contractors not only for work partially completed but also for material placed on the site and at central stock piles.

There is no doubt that material men on their part, on account of this meeting, will make the greater preparations for the season's business, and are enabled to do so by getting into the game early in the season, and taken altogether, the prospects for completing Wisconsin's huge 1920 program are very bright. Wisconsin's example in holding such a meeting is worthy of emulation.

Winter Prices for Aggregates

At one meeting held bids were submitted to the commission on stone, sand and gravel for winter delivery, as follows:

Crushed Stone—

Racine Stone Co., Racine—$1.25 per ton.
Lippmann Stone Co., Lannon—$1.20 per ton.
Waukesha Lime & Stone Co., $1 per ton.
Wisconsin Granite Co., Chicago—$1.20 per ton.
Sheboygan Lime Works—$1.20 per ton.
Universal Granite Quarries Co., Chicago—$1.15 per ton.
Mayville White Lime Works—$1 and $1.20 per ton.
Union Lime Co.—$1 and $1.10 per ton.
Lake Shore Stone Co., Milwaukee—$1.20 per ton.

Gravel and Sand—

Federal Sand & Gravel Co., Beloit—Sand, 75 cents; gravel, 85 cents per ton.
Morain Gravel Co., Plymouth—Sand, 65 cents; gravel, 75 cents per ton.
Waukesha Lime & Stone Co.—Sand, 60 cents; gravel, 70 cents per ton.
Waukesha Sand & Gravel Co.—Sand, 70 cents; gravel, 80 cents per ton.
Elkhart Sand & Gravel Co.—Sand, 50 cents; gravel, 70 cents per ton.

Wisconsin Mineral Aggregates Association Meeting

THE SECOND ANNUAL MEETING of the Wisconsin Mineral Aggregates Association is being held as this issue of ROCK PRODUCTS goes to press (December 18). From the above article there is every reason to believe some interesting matter will develop. The next issue will have a full account of this meeting.

Well Drill Blasting in Southern Quarries

General Observations and Conclusions from Experience in Regard to Placing and Depth of Holes, Charging, Etc.

By H. H. Hamilton*

THIS IS A LARGE SUBJECT, but one in which there is a growing interest among quarrymen. As I am especially familiar with the limestone, blue shale and granite quarries of the southeastern section of the United States, I shall confine this paper to conditions existing in that section.

Most of the operations are pit quarries. Some are hillside quarries.

Well Drilling Not Always Feasible

Well drill blasting is not feasible in all quarries. Where it is practicable, it has many advantages over other methods. Before adopting the method, one must know for what the stone is to be used, whether it is solid or fissured, whether stratification is horizontal, vertical, or pitching and if pitching, how much and in what direction from the face; must consider the height and length of face, area of floor in the quarry, distance to the crushing plant, method of loading, crushing and hauling.

For instance, there is one quarry here, the manager of which would like to use well-drill holes. It is impractical because the quarry has a face of 203 ft. high and only 80 to 100 ft. of floor. Of course, that makes an area too small to contain the amount of stone that would be shot down by a well-drill blast.

I do not believe that well-drill shooting saves any dynamite. It does, however, save much man-power. For instance, one driller and a helper can break as much stone as eight or ten tripod drills, which would require 16 to 20 men to operate. Well drilling would also release one blacksmith. There is also a large saving in power as a well drill operates from an independent power plant—steam, gasoline, or electric.

Well drilling eliminates bench clearing and does away with wall men.

Owing to the scarcity of labor, steam shovels are now commonly used in stone quarries. These cannot be operated economically where the broken stone is spread out too thinly by the blast. In other words, steam shoveling is not economical by the benching method employing small drills, but is very efficient in connection with well drilling. The well-drill blast brings down a large volume of rock, which is deposited thickly on the floor and it is not necessary to move the steam shovel and tracks very often.

Another way in which well drilling saves labor is on track work. It is not necessary to take up and re-lay tracks nearly as often when well drilling is employed, as is necessitated by other methods.

Well drilling is also much safer because, as a rule, there is loading and blasting only about four or five times a year instead of every week or two. Then, too, the loading of big well-drill hole shots is always entrusted to more experienced men.

When well-drill blasting is employed, it is generally possible to break enough rock in the fall to keep the shovels and crushers going through the winter. This greatly increases the output from the quarry.

Placing of Holes

No hard and fast rule can be given as to distance between holes or as to locating holes back from the face. In this district, the average distance back from the face is about 25 ft. for holes over 75 ft. deep and 20 ft. back for holes less than 75 ft. deep.

The spacing between holes often varies 10 to 15 ft. in the same quarry. For instance, a pit quarry in this district working a limestone formation that pitches about 25 to 100 ft., and stratified from 10 to 50 ft. thick, with an 80-ft. face on all four sides, has one face where the holes are placed 30 to 35 ft. back from the face and 25 to 30 ft. apart, drilled just to grade and requiring less explosives than holes on the opposite side, spaced 18 ft. back, 15 to 18 ft. apart, and drilled 10 ft. below grade.

Where steam shovels are being used, it is well to use double and sometimes triple lines of holes. We have found that a double line of holes in limestone will break the stone smaller and leave it in better shape for the steam shovel.

The third line of holes has not been a success in limestone quarries as it results in leaving too much bottom. In shale, however, where the strata are horizontal and the material mined softer, good results are obtained.

In drilling double lines of holes in limestone, the back row is placed either directly behind the front holes or about half way between them. The back row is also placed 15 to 20 per cent closer to the front row than the front row is to the face. Both rows of holes are charged with the same amount of explosives.

The double row of holes is particularly adapted to faces from 30 to 60 ft. high, for on these comparatively low faces, a single line does not bring down enough stone to work well with the steam shovels.

Where, due to conditions, a large toe is to be blasted or where holes have too much burden at the bottom, we have not found chambering of well holes good practice. We have substituted snake holes, starting about two feet above the quarry floor and drilling horizontally three or four holes between each well. These are drilled 16 to 24 ft. deep and chambered. They are loaded and connected in with the well-drill holes and all fired at the same time. This takes care of the toe and helps the big holes to make a good bottom for the quarry.

Charges to Use

Local conditions govern the amount and kind of explosives to use. Generally, it is important that the material be broken as fine as possible with the initial blast. When there is water in the holes, we use from 100 to 250 lbs. of 60 per cent gelatin with a straight N. G. primer of from five to ten cartridges, 1¼x8, in the bottom. This amount should bring the charge above the water. Above that the cheaper ammonia dynamite can be used without loss of efficiency.

The split or divided charge is sometimes used to advantage. Generally holes can be loaded to within 15 ft. of the top, but when the main charge stops 25 ft. or more from the top, we have found that a small charge of about 50 cartridges of 60 per cent dynamite, placed about half way up the hole in the tamping, assists greatly in breaking the top and avoids overhanging rock.

For loading I prefer a wooden block, one inch smaller in diameter than the hole, from 4 to 6 ft. long, with a rope in the middle of one end. These blocks should never be tapered. If they are, they are quite apt to clog in the holes.

Exploding Charge

I prefer countered Cordeau fuse to fire the charges, using one electric blasting cap on top of each hole to set off the shot.

When current from a power circuit

*E. I. du Pont De Nemours & Co., Wilmington, Del.

is used, holes should be connected up in parallel; that is, stretch two lines of leading wire behind the holes, connect one wire from each electric blasting cap to one lead wire, and the other cap wire to the No. 2 line. It is almost impossible to wrap a small wire tightly around a big wire. It is advisable to solder the joints with a blow torch.

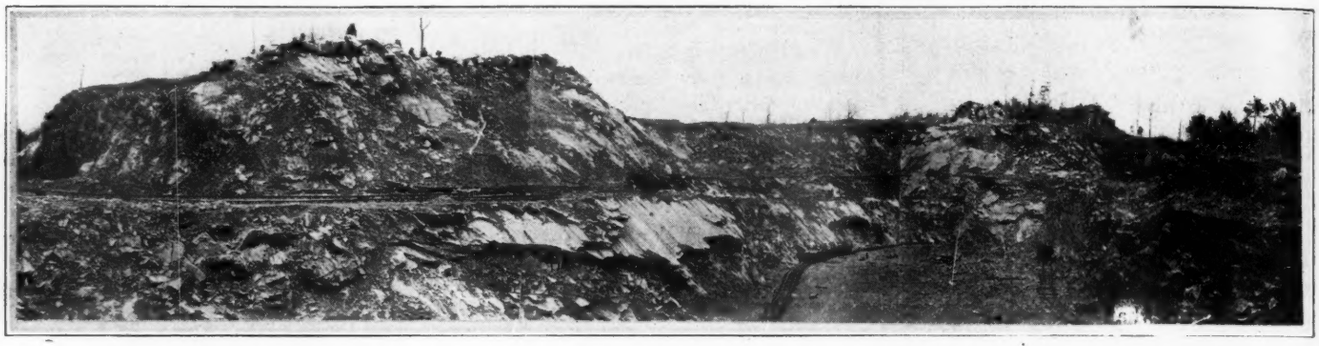
Where a current is not available, a small D. C. motor can be used as a generator, driving it with a belt from a balance wheel or big fly wheel on the well drill.

I have used a 5-h.p. D. C. motor with good results. By connecting a light bulb into the circuit, I can tell when I have a good current. The light should be turned off just before the shot is fired. Blasting machines are not satisfactory for firing well-drill shots; they do not generate sufficient current.

There should be at least one electric blasting cap to every 20 ft. of powder in the hole. Even this sometimes leaves some unexploded dynamite in the bottoms. When Cordeau is used, we never find any unexploded powder. We have never heard of a missed or failed hole in our section when we have used Cordeau with one electric blasting cap on top of each hole to detonate the charge. When this method is employed, all connections and electric blasting caps are on top of the ground, where they can be safely and quickly connected and fired either in series or parallel.

Conclusions

Well drill blasting is becoming more popular every day in the quarries in the Southeast. I believe the time is near at hand when it will be the method used in all quarries where physical conditions do not make it impractical.



Quarry of the Southern States Portland Cement Co., Rockmart, Georgia, showing conditions which make well-hole drilling practically impossible—both from the dip of the limestone strata and the variation in the analysis of the stone

Premature Quarry Blasts

THE investigation which was made of two premature explosions in two different quarries brings out the fact that people who for a considerable time without any trouble have handled explosives gradually become lax in their methods. Therefore, it cannot be too strongly emphasized that the men in charge of the quarry operations can never be too careful.

The two premature explosions mentioned were undoubtedly due to carelessness. One was due to excessive tamping as far as it has been possible to determine and the other to poor wiring. For the first one it is somewhat difficult to state the exact condition under which the charge in the drill hole was set off inasmuch as the statements made by the only two men who can give any explanation are somewhat contradictory. Circumstantial evidence, however, points to careless tamping. This explosion killed two men.

About the reason for the other explosion there can be no doubt. The entire line of holes had been connected with a Cordeau trunk line to which two exploders were attached, and to complete the wiring it was only necessary to connect the lead wires. This was done only a few steps from the row of holes. One lead wire had been attached to one exploder and as soon as the other wire touched the second exploder the entire charge exploded with the result that one man was killed. The shooting was done from the lighting circuit in the quarry and the circuit could only be closed by a switch located in a house at the bottom of the quarry. The wires to the shot were connected to the lighting circuit and in order to leave two railroad tracks open for traffic they were led from a pole on one side of the track underneath these and then up the face of the quarry to the shot. The wires were extremely poorly insulated—in several places entirely bare—and as it has since been found that there is considerable leakage of current to the rails under which the wires were drawn an electrical circuit must have been established as soon as both lead wires were attached to the exploders. It must be borne in mind that to set off one of the exploders a very small voltage is required, one volt is ample.

When Cordeau fuse is used and current is obtained from a power circuit too great care cannot be taken. Particularly must it be ascertained whether any stray currents are likely to be picked up by the circuit, and it goes without saying that only wires with the best possible insulation must be used.

When using Cordeau it would be far safer to take the required current from a battery which could be placed in a steel shelter house at the top of the quarry several hundred feet away from the loaded holes. All necessary wiring can then be done in safety and when the shot is ready to be set off the blaster can make the final connection to the battery in the shelter house after all persons have gone to a safe distance.—"Accident Prevention" Bulletin of the Portland Cement Association.

Employers' Liability in Blasting Accidents

IN THE OPERATION of a quarry by a cement company, the employees on a signal given were permitted to use a rock house and an oil house as places of refuge. On a signal being given, an inexperienced employee, with others, resorted to the oil house for protection from flying and falling stones. While so waiting a fragment of stone tore through the house and killed the employee. In an action for damages for the death of the employee it was a question of fact for the jury to determine, whether the employer exercised reasonable care to provide a safe place for his employes proportionate to the dangerous nature of the means and instrumentalities employed in the business of quarrying stone. Whether the signals and places of refuge provided by the employer were reasonably sufficient and proximate to the place of work, as to afford time within which employees so engaged, and about to be imperilled, might retreat to such places of refuge, and whether such places were reasonably sufficient to afford protection to the employees, were questions of fact for the jury to determine.—J. W. Thompson, "Abstracts of Current Mining Decisions."

Fire Resisting Qualities of Limestone Concrete

Tests by U. S. Bureau of Standards Show Limestone Concrete Retains Strength After Exposure to High Temperatures Better Than Concrete of Other Aggregates

THE RESULTS of a comparison of the heat insulating properties of some of the materials used in fire-resistive construction have recently been published as No. 130 of "Technologic Papers of the Bureau of Standards," by Walter A. Hull. Mr. Hull is the author of the paper on fire tests of reinforced concrete columns, presented at the last meeting of the American Concrete Institute. (See ROCK PRODUCTS, July 5, 1919, p. 55.)

This bulletin covers a preliminary investigation and should be read in connection with the article on the fire tests of columns. Concrete specimens made of different aggregates were subjected to furnace temperatures for several hours and the progress of the heat through the material and the condition and strength of the specimens afterward were noted. Besides concrete, clays, gypsum and lime mortars were also tested. The aggregates used included Pittsburgh sand and gravel, New York trap rock, Pennsylvania limestone and Pittsburgh slag.

The report states:

The consistently lower final temperature shown by the limestone concrete specimens is rather surprising, in view of the fact that limestone concrete is not generally regarded as particularly good concrete for fire-resistive construction. In these tests the limestone concrete seems to have shown superiority over the others in point of rate of temperature penetration.

If there were a consistent tendency for heat to penetrate the limestone concretes more slowly than other concretes, it would have a bearing on practical construction, since it is probably safe to assume that at temperatures higher than the ordinary, the strength of a concrete is a function of the time and temperature. This being the case, a tendency on the part of any aggregate to retard temperature rise through the mass of a load-bearing member would be distinctly in favor of its use in fire-resistive construction.

Attention has already been called to the fact that in an accidental fire the thermal behavior of a material will be affected by the absorption of heat by endothermic chemical reatcion, if the composition of the material be such that such a reaction will take place. In the case of the limestone-concrete specimens tested in this investigation, it was observed that on exposure to atmospheric conditions after the test, the outer portion next the cylindrical surface slaked and fell off. It was found that the thickness of the portion which came off in this way was fairly uniform and approximated 5/16 in. The slaking was, of course, due to the decarbonation of the limestone in this portion of the concrete.

Calcium carbonate dissociates rapi to CaO and CO_2 at 898° C. at atmospheric pressure. It is evident therefore, that this temperature was attained in the limestone-concrete specimens to a depth of approximately 5/16 in. The temperature records of the burns of these specimens show that this temperature was not attained at a depth of ½ in. The weight of the limestone decarbonated in each of these specimens was approximately 6 lbs. The heat of dissociation of $CaCO_3$ at 900° C as obtained by interpolation between figures given is 396 calories per g. The heat absorbed by the evaporation of water at 100° C is 540 calories per g. Therefore the quantity of heat absorbed by the dissociation of 6 pounds of $CaCO_3$ would be as great as that absorbed by the evaporation of $\frac{396 \times 6}{540} = 4.4$ lbs. of water.

This is a rough approximation, as the quantity of limestone decarbonated is estimated from the approximate thickness of the layer of material that slaked off. It will suffice to show, however, that a considerable quantity of heat was taken up in this way, although it should be taken into consideration, on the other hand, that the effect of heat absorption taking place close to the surface of the cylinder would be much less than that of the absorption of the same quantity of heat taking place throughout the mass. This is obvious when it is considered that heat can reach a point near the surface much more readily than it can penetrate to interior points, so that one heat unit eliminated at a depth of about 2 in. from the surface counts for as much as several heat units absorbed near the surface.

Another thing which undoubtedly had some effect in the heating of the limestone concretes is that the residual CaO resulting from the decomposition of the limestone was presumably of lower thermal conductivity than the limestone itself, and this of course would result in better resistance to heat flow after the decomposition started to take place than before.

There are seen, therefore, to be two factors entering into the thermal behavior of limestone concrete which do not enter into that of the other concretes included in the series under consideration, and both of these factors have a tendency to retard the rise of temperature of the concrete mass. Taking these factors into account, there seems to be a reason for the performance of the limestone concretes in these tests.

It seems reasonable to suppose also that specimens in which the average temperatures attained throughout the mass are lower than those attained in other specimens will retain more strength, other things being equal. In this investigation compressive tests were made of a number of the specimens and the strength of the limestone-concrete specimens was somewhat greater than that of the other specimens which were tested for strength.

While these results are favorable as far as they go to limestone concrete as a fire-resistive material, the fact should not be overlooked that the decarbonation of limestone, to which the lower final temperatures of the limestone concrete are attributed, does not take place to any important extent in high-calcium limestones at temperatures which do not approximate 900° C, so that little thermal advantage from this dissociation would be gained in a fire unless the surface of the concrete reached such temperature which means that such an advantage would be gained only in fires in which comparatively high temperatures are attained.

The results obtained in this investigation differ somewhat in respect to the limestone concretes from the conclusions of Prof. Woolson from the results of his investigations in 1905 and 1906. Prof. Woolson's work was done with specimens somewhat smaller than those used in this investigation, namely, 4-in. cubes and 6 by 6 14-in. prisms. This would tend to result in a large proportion of the limestone being decarbonated in long exposures to high temperatures and would account, at least in part, for the apparent discrepancies between the results of his 1905 tests and those shown in this series. It is to be noted that in Prof. Woolson's investigation in 1906 some results were favorable to trap rock and others favorable to limestone concrete. This would indicate that there was not enough difference between the two to show results consistently favorable to either. Considered in connection with the foregoing statements regarding decarbonation, this is what might be expected, for in Prof. Woolson's 1906 investigation the furnace temperatures did not exceed 815° C, at which there would be practically no decarbonation of a high-calcium limestone.

Most of the limestone-concrete specimens were intact when removed from the furnace, but a few of them were broken in two laterally, near the middle. Except for the thin outer layer previously referred to, which slaked and fell off, the limestone concrete cylinders were stronger and more nearly sound than those from other kinds of concrete with the possible exception of the clinker concretes.

Remodeling of Old Rock Crushing Plants

Part II—What Can Be Accomplished by Adding a Larger Primary Breaker

By Brownell McGrew

A PREVIOUS article has dealt in a general way with some of the problems of the small producer of crushed stone. This article deals with advantages of steam-shovel quarry operation when an adequate primary crusher is provided.

Primary Breakers

Generally speaking, the most important and far-reaching alteration that can be made in the small crushing plant is that of introducing a larger primary breaker. There are, no doubt, many small operators who will, at first thought, object to this expedient on the ground that the installation of a larger main crusher will entail enlargement of the plant throughout. Undeniably, the objection is valid as regards many plants—particularly so if the operator feels that the only justification for the employment of a larger crusher lies in realizing the full capacity of that machine. But the big breaker has another potentiality which stands on a par with the element of increased output; namely, that of cutting down quarrying cost; and this cut in cost may be effected *with* or *without* augmented production.

As an example, consider the small plant, originally designed to operate on hand-loaded stone. The radical changes in labor conditions that were ushered in with the war forced a considerable number of the operators of these plants to change from the hand-loading system to the steam shovel. In this change there were both advantages and disadvantages. It was certainly a long step toward the solution of the labor problem; but the production was, in the majority of cases, materially lowered, due chiefly to the bridging and choking of the primary crusher when handling the shovel-loaded stone. Another disadvantage of using the steam shovel in connection with small crushers, is the numerous and costly delays incidental to repeated plug drilling and shooting in front of the shovels. This factor has made it necessary, in some quarries, to use twice the number of shovels that would be required if the primary breaker were large enough to cut secondary shooting to a minimum.

Bringing Capacity Back to Hand-Loading System

In treating of the installation of larger crushers in these plants, we will first suppose that it is simply desired to bring the capacity of the plant up to what was possible under the hand-loading system. The new primary breaker may be installed in the plant in two general ways: (1) It may replace the old machine, in which case the latter would be removed from the plant. (2) It may be installed ahead of the old crusher, using the latter as a secondary crusher. Whether the first or second method is advisable will depend, of course, upon local conditions. As a general rule, the second—that of leaving the old breaker in for a secondary—will be found to be the better expedient, as it offers greater possibilities in designing an economical plant.

One instance where the first method might be found to be the better is where it is intended to replace a gyratory crusher with a jaw crusher for the sake of the larger receiving opening that the jaw crusher affords. Here, however, must be taken into consideration the fact that the jaw crusher will not operate satisfactorily on as fine a setting as the gyratory, and there may be danger of choking the plant or overloading the rejections crushers with the coarser output of the former. The writer has seen this occur in a plant where a 42-in. gyratory was replaced by an 84x60-in. jaw crusher, and the same will, naturally, hold true for smaller installations.

When the old breaker is replaced by one of higher capacity it will be necessary to provide some means of feeding its product to the rest of the plant at a rate that will not overload the latter. Most small plants of the old type are equipped with bucket elevators which receive the material direct from the primary crusher and elevate it to the screens. To adjust the flow of stone to the capacity of this elevator—and hence to the screens and re-crushers—a hopper may be installed below the new primary breaker, and a mechanical feeder used to deliver from hopper to elevator. The hopper should be large enough to hold at least two quarry-carloads of stone, and preferably larger, in order to provide a measure of flexibility between the primary breaker and the rest of the plant, and to lessen the danger of packing the crusher in case of accident to the feeder or elevator.

In some plants it may be preferable to install an elevator of sufficient capacity to take care of the output from the ment of feed must be taken care of at new crusher. In this event the adjustthe receiving end of the screens. This arrangement can often be used to advantage where, instead of placing the new crusher in the same position as the old machine, it is installed at another point, and the bucket elevator is replaced by a belt conveyor or by skips.

Utilizing the Old Main Breaker

One of the chief advantages of the second method of installation—that of utilizing the old main crusher for a secondary to the new breaker—is that, regardless of the size, type, or capacity of the latter, no changes need be made in the old plant to enable it to take care of the product of the big machine and thus bring the capacity of the plant as a whole up to that of the secondary crusher.

In other words, the quarry operator who has suffered a decrease in production on account of being forced to change from hand loading to steam-shovel loading can bring his output back to its former standard by simply installing the larger crusher and some means of getting the stone from it to the secondary. This arrangement, with a receiving hopper over the smaller crusher to take the discharge from the primary machine, provides the necessary flexibility, and at the same time delivers to the plant the quantity and size of material for which it was originally designed.

As mentioned in the writer's articles on "The Design of Large Rock Crushing Plants," there will be little or no difference in the gradation of the stone whether the reduction has been made in one machine or in more than one, and the flow sheet of the operation will be substantially the same.

Naturally, when the secondary crusher layout is adopted the question will arise as to whether or not a scalping screen between the two machines is advisable. In the greater number of instances this question can be answered in the negative. If the capacity of the new breaker is higher than that of the secondary, as it generally will be, the action of the scalping screen in by-passing part of the material around the smaller crusher will throw upon the balance of the plant a load equal to the output of the crusher, plus the segregated undersize. Obviously, a plant that was designed to handle the output of the crusher alone will be overtaxed by the increase in load. Even when the capacities of the new and old crushers are approximately the same, as will frequently be the case when a jaw crusher is placed ahead of a gyratory,

the expediency of employing a scalping screen is doubtful. It adds a machine to the plant, thus increasing the power consumption and maintenance charges, and confers no benefit beyond that of a slight reduction in the work of the secondary crusher.

Location of Primary Breakers

In choosing the location of the new primary breaker due consideration should be given to the influence any particular setting will have upon quarry operations, both present and future. It is frequently the case that an installation admirably adapted to present operating conditions would seriously handicap the effectiveness of the plant for service in connection with proposed quarry development.

An example of this will often be met with in the remodeling of an incline-fed plant, receiving stone from a pit quarry that is being worked down in successive levels. There are a number of small plants of this character where, for present operating needs, a very satisfactory arrangement would be to install the new crusher in a pit at the foot of the incline, and use the latter structure as a supporting framework for a belt conveyor to elevate the stone to the secondary crusher. Here, though, one is generally confronted by the fact that the lowering of the quarry floor would destroy the effectiveness of the pit installation, and would render it very difficult to work out the stone surrounding the crusher without damaging the foundations and machinery.

For an operation of this kind the new crusher may be placed above the brow of the quarry, retaining the incline; or a modification of the first layout may be adopted—placing the crusher on the quarry floor and using a short incline to feed it, and the belt conveyor or another type of elevator to take the stone to the secondary. With this arrangement the crusher and incline should be so disposed that the latter may be lengthened when the quarry floor is lowered.

If the old primary crusher is in a pit, it may be desirable to place the new crusher above it, and to go up over the latter with an incline, or a long grade up which the trains could be drawn by the same motive power than handles them in the quarry. The latter method, where it is feasible to apply it without introducing too long or too sharp a grade, is an excellent arrangement; but the adoption of an incline would in most cases be a step backward, and it is generally preferable to place the new crusher in a pit beside the old machine and to install a short elevator to transfer the material from one machine to the other. Another method that will recommend itself under certain conditions is to remove the old machine from the pit, replace it with the new crusher, and reset the old machine at some point between the primary crusher and the screening plant. This may or may not involve the installation of an extra elevator, depending upon the location selected for the secondary.

Selecting the Crusher

The size and type of the new primary crusher should be decided only after a thorough study of the conditions which the machine will have to meet. Figuratively speaking, one must stand in the middle of the proposition and examine both ends of it. In other words, the receiving opening of the new crusher should fit the quarry, and the discharge opening, the plant. If any compromise must be made, it is better to favor the large receiving opening and to adjust the plant to take care of the coarser discharge, even though this course raises the cost of remodeling. On the other hand, there is nothing to be gained by putting in a bigger machine than the character of the stone demands. An examination of the stone as it comes out in the primary blast will be of great assistance in selecting the best size of receiving opening.

The element of capacity is frequently a deciding factor in choosing the type of crusher. Where it is necessary to elevate or convey the material from the new crusher to the secondary, the size of the elevator or conveyor required is directly dependent upon the amount of material which it will have to handle. Also, when the secondary crusher is not employed, the same holds true for the size of the screening and re-crushing plant, unless—as suggested in the section on "Primary Breakers"—some means of regulating the flow of stone to the elevator or screens is installed.

Therefore, it is obvious that, other things being equal, the best practice is to have the capacity of the new crusher balance as nearly as possible that of the rest of the plant. For this reason, the jaw crusher, with its large receiving opening and comparatively low capacity, will generally be chosen in preference to either the gyratory or roll crushers for installation in small or medium size plants, provided that the coarseness of its product does not offset its other advantages.

Results to be Attained in Plant Changes

The foregoing is based on the supposition that it is merely desired to bring the plant output under the shovel loading system up to what was possible with the old primary crusher when operating on hand-loaded stone. Those operators of small crushing plants who are now using the steam shovel will, generally speaking, realize the following benefits by adding the proper size of primary crusher to their plant: (1) A substantial cut in the cost of secondary shooting in the quarry. This is commonly one of the most important arguments in favor of a larger crusher, and it is an argument that will justify itself in dollars and cents. (2) A decrease in the unit cost of loading, on account of the fact that a greater output can be obtained from the same number of shovels, or the same output can be obtained with a smaller number of machines because, as before stated, the delays for secondary shooting in front of the shovels will not be so great as with the small primary breaker. In fact, if the new crusher is made large enough, this shooting in front of the shovels can generally be eliminated altogether except when solid toes, or benches, are encountered. (3) Crushing costs will be lowered. The increase in output may be attained with the same or even a smaller force in the plant. This cut in the force will be particularly noticeable where the incline type of plant is altered to a crusher pit type. The unit cost of power will, in the majority of instances, remain about the same, or it may be slightly increased. (4) The cost of quarry transportation may or may not be decreased, depending upon the style of equipment used, and whether it is proposed to change this equipment for a type that would better suit the new installation. This is a question that frequently comes up when the plant is changed from the incline to the crusher pit type. It will be mentioned again later in the article. (5) All fixed charges, such as supervision and miscellaneous overhead, will be lower, of course, due to the increase in output.

The next article will discuss some of the results attained by the changes described above, when it is desired to increase the capacity of the whole plant.

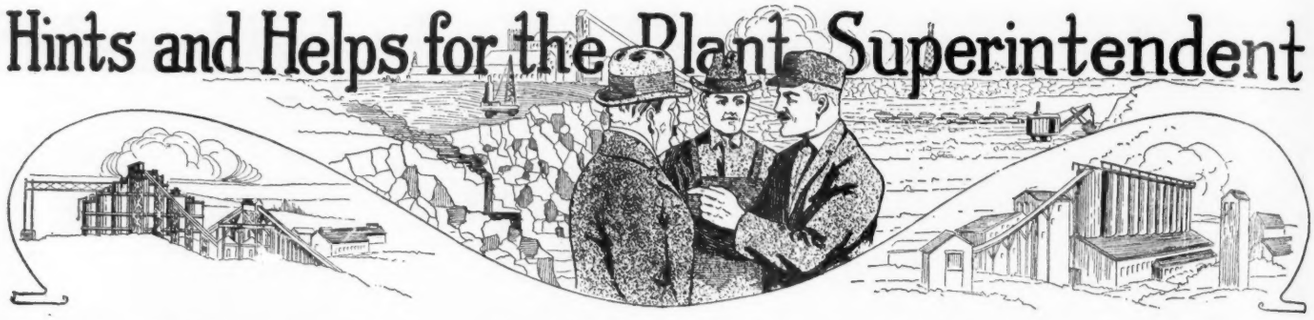
Hydrated Lime Experiment in New York State

AN EXPERIMENT in the use of hydrated lime in concrete pavements is being made by the New York State Highway Department on a road near Buffalo.

The work will consist of the construction of alternate slabs with and without lime, the slabs being 30 ft. long, which is the standard length in the state. The Lime Association, which is co-operating in the work, is represented by T. B. Shertzer, Eastern District Engineer.

Plans are being made to conduct similar experiments in the eastern part of the state.

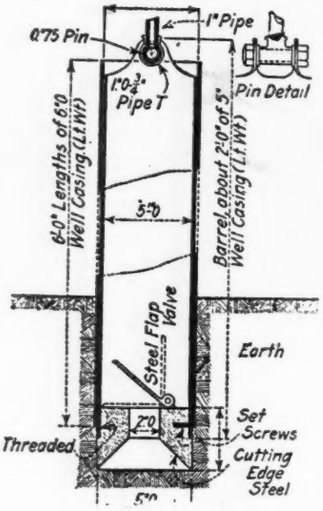
Hints and Helps for the Plant Superintendent



Might Be Used for Sampling Sand Deposits

THE ACCOMPANYING SKETCH shows an arrangement devised for obtaining bore samples. The device consists of an outer section, composed of 6-in. light weight well casing, which is forced down by a weighted platform.

The inner section is made of 5-in. light weight well casing and carries the cutter. The two sizes of casing rest snugly, but not tightly, so that the barrel moves freely within the outer case.



Soil-testing device

The arrangement was designed by R. R. Ryan and was first used in 1909 in bringing up samples of the soil at the site of Florence Bridge, Florence, Ariz. The tool is simple in design and has proved very efficient.—"Successful Methods" for December.

While the opening in the device shown (2-in.) is too small for sampling gravel deposits, it might be made of a little different construction and used for that purpose.

Rock Products will pay $5 for a brief description of the best method of sampling gravel pits—Editor.

Modernizing an Old Lime Plant

THE ILLUSTRATIONS herewith show a historic lime plant modernized by the installation of an electric-motor driven portable conveyor for handling lime as drawn from the kilns. Many more-recently built plants still use wheelbarrows and push carts. In almost any old lime plant two operations can be improved—coal handling and lime handling. The illustrations are from photographs taken at the Cedar Hollow plant of the Charles Warner Co., and show a battery of its oldest kilns, which are still doing good service.

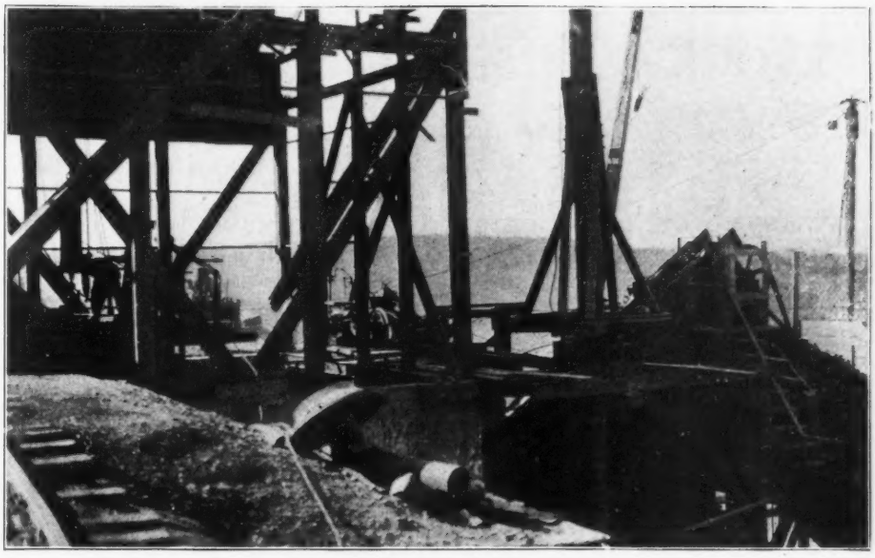
Battery of old lime kilns modernized by portable conveyor

Another view of conveyor and method of using it

Strategically Placed Derrick

A FREQUENT CAUSE of delay and high cost in making repairs at crushing plants is the lack of proper facilities for handling heavy pieces of machinery. One of the cheapest, simplest and most useful of all apparatus for handling heavy things is the common, ordinary variety of revolving derrick.

The use of a derrick is of course much simplified by an out-of-door arrangement of the crushing machinery, as shown in the view herewith. This derrick can handle parts of any of the battery of secondary crushers shown at the right, and in an emergency could be used to handle parts of the primary crusher, under the roof at the left, as it was doubtless used for the original erection of this crusher.

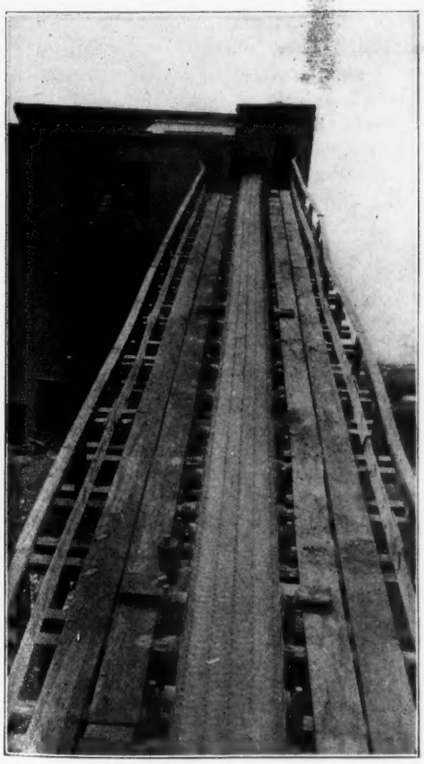


Derrick for handling plant repair parts

Method of Increasing Capacity and Life of Belt Conveyor

THE FEDERAL SAND AND GRAVEL CO., Beloit, Wis., is using the method here illustrated to increase the life and capacity of its belt conveyor from the unloading hopper to the screens.

Ordinary rubber conveyor belting is purchased and the steel strap sections are riveted on at the plant. It is claimed that the belt, when so covered, will last twice as long as the ordinary belt, and that the capacity is more than doubled.



Conveyor belt with steel straps riveted to carrying face

Dynamite storage house of the Columbia Quarry Co., St. Louis

Storage of Explosives

THE COLUMBIA QUARRY CO., St. Louis, E. J. Krause, vice-president and general manager, is the owner and builder of the dynamite storage house shown above. This neat building is of brick with a reinforced concrete floor, which is amply supplied with air ducts to insure perfect ventilation in connection with the galvanized-iron vents in the roof.

This building is equipped with properly protected steam-heating pipes, and in winter a small traction steam shovel or other form of portable boiler is moved near the house and connected up with the heating system. Thus the powder is ready for use at all seasons without the dangerous thawing-out process.

The house is provided with a heavy, tight-closing, sheet-steel door with a combination lock, making it proof against marauding bolsheviks or other enemies of peace and order. The building is banked on three sides, as shown, the entrance facing the quarry, which is several hundred feet away. The purpose of thus banking the sides of the building is to direct the force of any explosion either upward or toward the quarry, where it would do the least harm. The crushing plant is to the right of the view shown, at a distance of several hundred feet.

Question Box

GOT a problem you want help on? Send it in. We will agree to find some operating man who can answer it.

Rock-Crushing Plant with Large Size Railway Car Dumper

Hawkeye Portland Cement Co. Dumps 50 Tons of Limestone Into Big Gyratory in One Operation

SEVERAL CEMENT PLANTS are located at some distance from their sources of raw materials, but generally in such instances the limestone or shale is crushed at the quarry. In the case of the Hawkeye Portland Cement Co., whose plant is just outside of Des Moines, Ia., the quarry is at a distance of about 50 miles from the plant, but the stone is brought to the cement plant to be crushed.

The rough quarry stone is brought as ordinary freight by the railway company from the quarry to the plant in standard gondola or hopper-bottom cars. As the stone supply could not be made dependent upon obtaining hopper-bottom cars, the dumping device for the cars at the plant end had to be designed to handle any kind of rolling stock.

The problem was solved by the use of a standard car dumper of the type which has been used for a number of years at Great Lake ports for handling iron ore and coal, but this is probably the first use of one of the largest size car dumpers in the rock products industry.

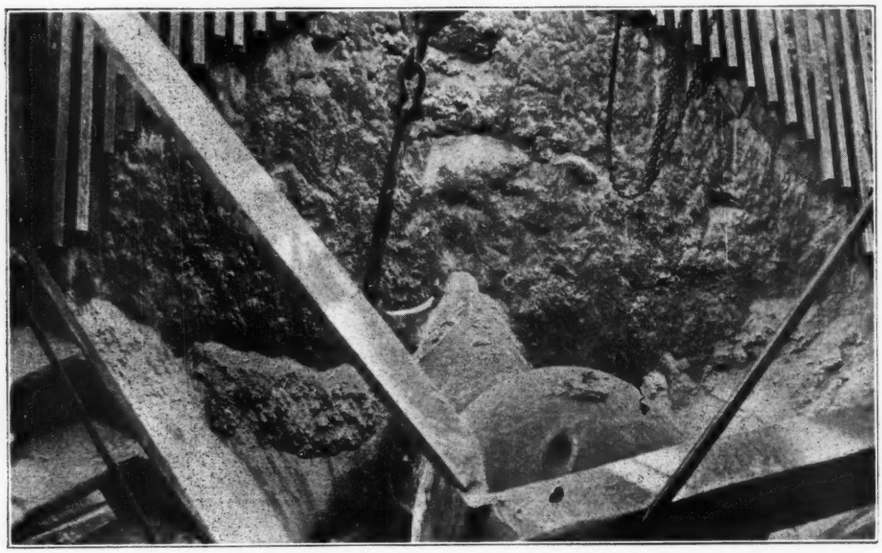
The essentials of the car dumper are shown in the accompanying illustrations. It consists of a tower structure of steel construction. The car is run on to a platform, which is raised like an ordinary elevator a height of about 30 ft. The steel frame carrying the car, which is of course securely locked in place, is swung about a pinion or turning point on the side of the structure nearest the crushing plant, so that the car is turned over sufficiently to empty it.

Special concrete counter-weights make it possible to dump a loaded car in about 2½ min. with a 250-h. p. electric motor. The addition of the counterweights makes it possible to utilize the same motor which was previously used to operate a car dumper of much smaller capacity.

The dumping of 50 tons of stone into the 42-in. gyratory crusher all at one time requires a feeding hopper of special design, which is shown in the accompanying illustrations. The opening across the top is about 40 ft., the length of a car. The hopper bottom is inclined at an angle of about 45 deg. and is floored with steel railway rails, with the heads up, and laid as closely together as the flanges permit. The sides of the hopper are lined with boiler plate and narrow the hopper or chute down to the width of the crusher opening.

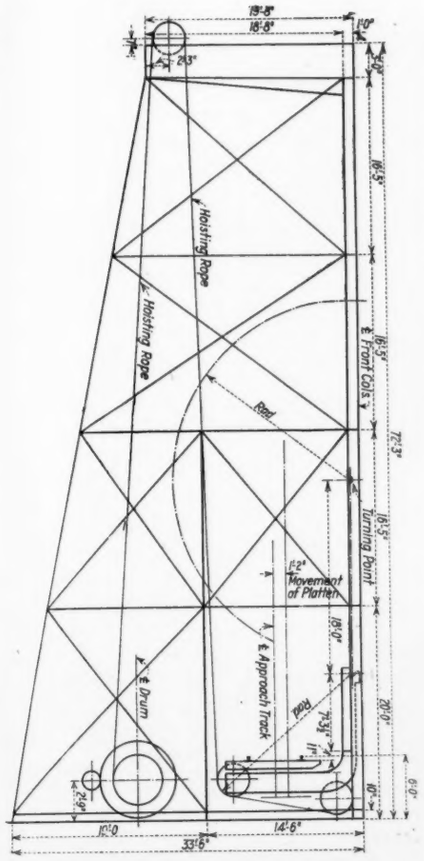
The crusher foundation is sufficiently elevated to allow the crusher to discharge into an elevator pit at about ground level. The stone from this primary breaker is elevated to a small storage bin which feeds the battery of secondary crushers, which are also so mounted that all their working parts are above floor level.

The primary crusher is equipped with a grappling hook for loosening large rocks when the crusher opening becomes choked. This hook is operated by a small electrically-driven hoist controlled from the platform back of the crusher. A chain hoist is also suspended over the crusher opening to further facilitate the handling of the large chunks, which is the chief problem to contend with in



Dumping hopper of 42-in. gyratory designed to handle 50 tons at a time

Another view of dumping hopper showing grappling hook and chain hoist



Outline sketch of car dumper

dumping and crushing rock in 50-ton batches.

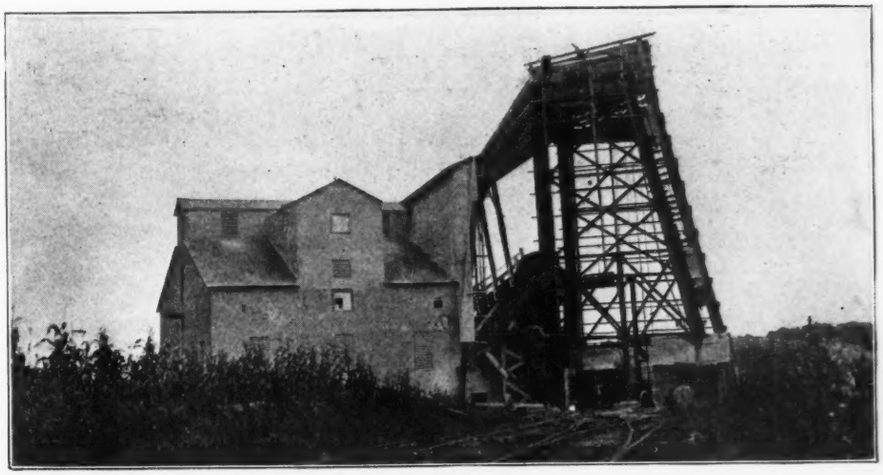
The car dumper was designed by the McMyler-Interstate Co., Cleveland, O., but the erection work done and many operating details were worked out by the cement company's own engineering force under the supervision of E. Struckmann, superintendent.

Cement Exports for September Nearly $900,000

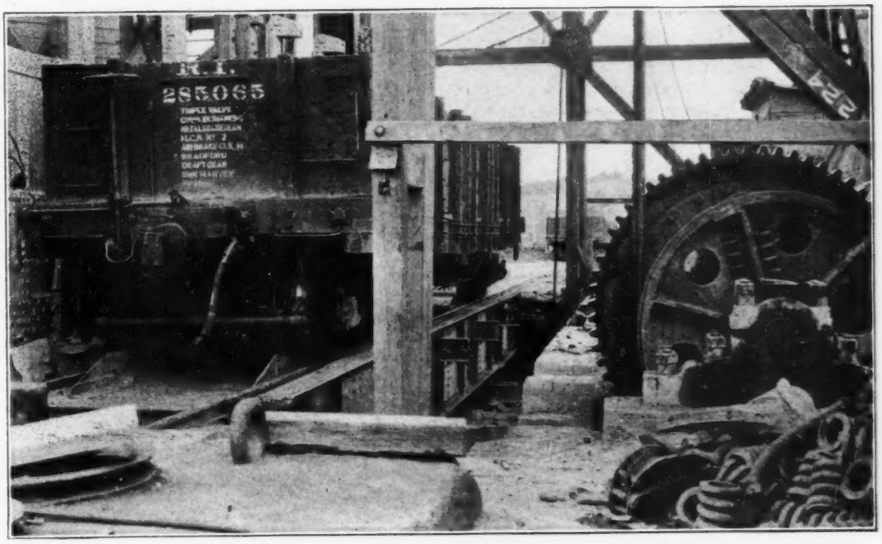
WASHINGTON, D. C.—Exports of cement during the month of September reached a total of 283,119 bbls., with a value of $889,197, according to a report just secured by the Washington Bureau of Rock Products from the Bureau of foreign and domestic commerce of the Department of Commerce. Imports during the month totaled but 26,790 pounds with a value of $243.

More than a quarter of the total exports were sent to Cuba, according to the department's figures, while large shipments were also made to Argentina and Brazil. Other South American countries were the principal buyers.

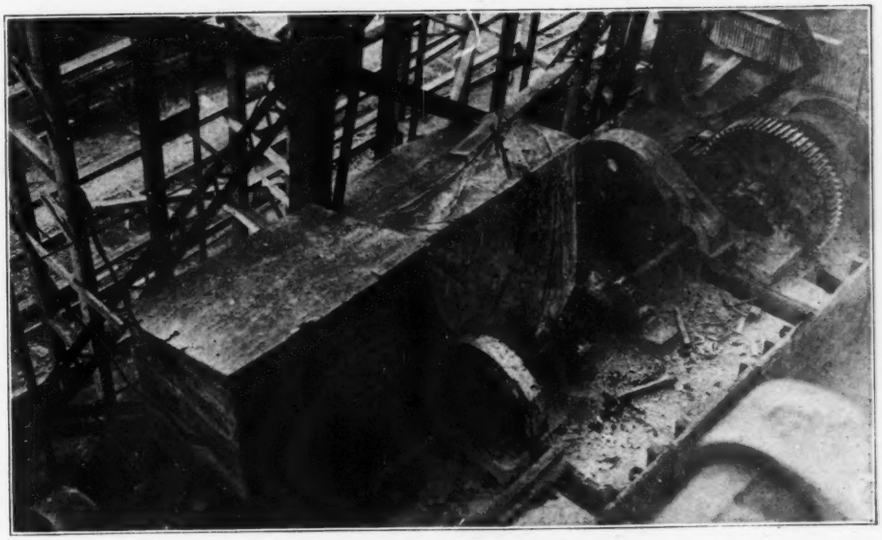
A more detailed statement of the export trade in Portland cement covering the first nine months of this year, will be found on page 31 of this issue of Rock Products.



View of car dumper and crushing plant—crusher hopper about half-way to top of structure, which is being roofed over



Car in place on elevator platform



Looking down on motor and hoisting drum

Florida Soft Phosphate

What It Is and How It Is Used

THERE ARE two general sources of phosphates for agricultural purposes —the bones of dead animals, and certain phosphate-containing minerals.

BONE PHOSPHATES—Under bone phosphates, we can classify, raw bone, steamed bone meal, tankage, bone black, etc.

RAW BONE MEAL is made by grinding the bones of dead animals; steamed bone meal is made from bones previously steamed to remove the fat, and for this reason will contain less nitrogen than raw bone meal.

The steamed bones can be ground much finer than raw bones, and for this reason will become much more available than the raw bone meal.

TANKAGE contains large percentage of ammonia and the phosphoric acid which may be contained will be largely determined by the amount of bone present in the tankage.

The supply of bone black is limited; it is made by heating bone in air-tight vessels until all the volatile matter is driven off, and then used in refineries to purify sugar, after which it is ground and used as a fertilizer material.

*From information furnished by Virgil H. Larner, secretary of the Soft Phosphate Association.

View of soft phosphate mine

General view of mine

Mineral Phosphates

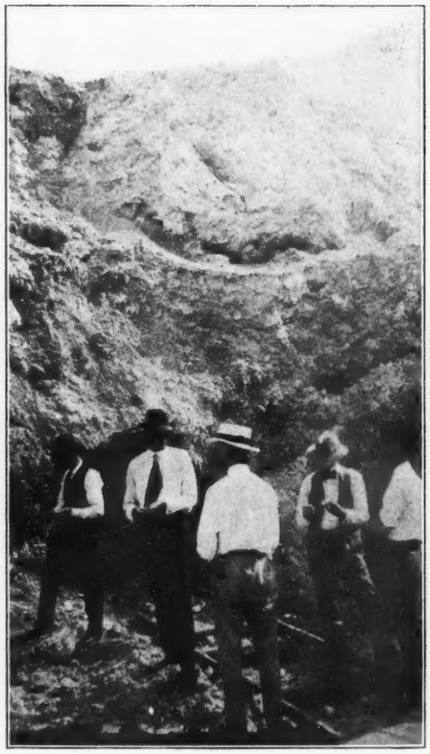
In a number of places rock deposits are found that contain varying percentages of bone phosphate of lime.

These deposits of phosphate rock will vary greatly in analyses and in appearance, due to the various formations. The method of production is largely determined by the condition in which it is found.

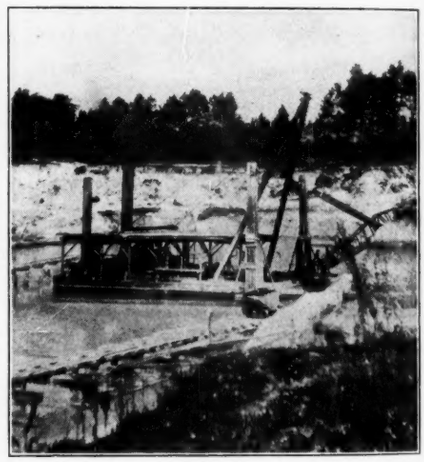
The largest deposits of phosphate in the world are in the United States, and those deposits which have been developed to greatest extent, and where largest tonnage of phosphate is mined, are in Florida, and there are three distinct types of phosphate found—Florida hard rock phosphate, Florida land pebble phosphate and Florida soft-phoshate.

There are two ways in which these mineral phosphates may be used: in the natural form after being finely ground,

Soft phosphate deposit



Phosphate bank 100 ft. high



Mining hard phosphate with floating dredge

Hydraulic method of removing overburden

or as acid phosphate after being treated with sulphuric acid.

Florida Hard Rock Phosphate

This form of phosphate is the highest grade phosphate mined in Florida; the formation is usually a hard and dense rock—as hard as flint or granite. It will show an analysis of from 32% to 38% phosphoric acid. Because of this high percentage and the fact that ocean freights are based on weight, and not grade, practically all of the Florida hard rock phosphate is exported to Continental Europe and Great Britain.

Florida Land Pebble Phosphate

This form is the kind generally used in the United States in the manufacture of acid phosphate. Florida pebble phosphate analyzes from 30% to 35% in phosphoric acid. This pebble phosphate is, as the name indicates, a pebble—hard, dense and gravel-like.

Acid Phosphate

Acid phosphate is the manufactured product of phosphate rock, either hard rock phosphate or pebble phosphate being used. In the process of manufacture practically equal parts of phoshate rock and sulphuric acid are used.

Acid phosphate is, however, the quickest source of phosphoric acid; that is, when applied to the soil the action will be the quickest, but this is not always the most vital and important thing.

General Use

The general theory is that hard rock phosphate and pebble phosphate must be treated with sulphuric acid to render it available as plant food, while soft-phosphate does not require this treatment.

There are, however, many advocates of raw ground pebble and of raw ground hard rock phosphates, and numerous instances of the very satisfactory results obtained when used.

Unless a soil is balanced, it will not yield to the maximum; if too acid, the germination of seed will not be best, nor will bacterial life, so essential, thrive in acid soil. For this reason soft-phosphate is an aid in sweetening the soil.

Soft-phosphate was never rock, nor will it ever be rock. It is a soft and porous material and therefore more soluble. When dried and ground and applied to the soil in its natural form, it becomes more quickly and completely available—soil soluble—by reason of its soft, porous character, as a plant food than any other form of un-treated phosphate.

Soft-phosphate analyzes from 22% to 30% phosphoric acid. It is never used in the manufacture of acid phosphate as is hard rock phosphate and pebble phosphate, as its very formation makes mixture with the sulphuric acid impracticable.

The fineness to which any product is ground, whether it be limestone, bone or phosphate very largely determines the quickness and completeness with which it will become soluble when put in the soil. Soft-phosphate is ground to extreme fineness—put through dryers and pulverizers of most modern design, and 95% of the product will pass 100-mesh screens, while 70% will pass 200-mesh screens.

Soft-phosphate is the lightest in weight and more bulky than any other form of phosphate. A 200-lb. bag of soft-phosphate will be from 25% to 30% more bulky than the same weight when ground phosphate is produced from either hard rock or pebble phosphate. This is evidence of greater fineness of division, and this fact alone insures greater soil-availability.

No guarantee is made as to the immediately available phosphoric acid that soft-phosphate contains. The laboratory result of the chemist will not show any great per centage, but it will be more in soft-phosphate than any other untreated phosphate. The facts are, however, it is a natural phosphate and when applied to the land the soil acids bring about action rapidly enough to meet the demands of the growing plant.

There are some opponents of the use of ground phosphate rock, but they base their views and opinions largely on results secured from use of ground hard rock or ground pebble, and most of the experiments heretofore conducted have been where this form of ground phosphate was the material used.

There are many instances where ground hard rock and ground pebble have given highly satisfactory results, and crop yields were in easy keeping with the investments made. Many farmers throughout the United States use this material regularly in preference to acid phosphate.

The contention is that there are just as many arguments against the use of acid phosphate because of its quickness of action, as against the use of ground hard rock or ground pebble phosphate because of slowness of action. On the other hand, soft-phosphate meets a middle ground as it contains sufficient phosphoric acid in quickly available form, and continues to supply the growing plant in a gradual way as required.

No Phosphate Price-Fixing

REPORTS that phosphate rock and bulk acid phosphate were to be subjected to Government control have been denied at the Department of Agriculture. The Secretary of Agriculture decided that no effort would be made to fix fair profits for fertilizer ingredients.

Growth in Use of Gypsum as Structural Material

SHORTLY BEFORE the entrance of the United States into the war the application of reinforced gypsum to roof construction was developed by one of the largest manufacturers of gypsum in the United States. A considerable amount of scientific work was done, which afforded a sound basis for the design. With these data as a basis, a member of the U. S. Bureau of Standards has participated actively with Virgil G. Marani, engineer of the Gypsum Industries Association in the formulation of standards for the design of reinforced gypsum, which have been accepted as a tentative report to the American Society for Testing Materials, and are being printed in the proceedings for 1919. During the war many thousand square feet of reinforced-gypsum roof, designed by these standards, were used in government buildings.

The standard method for measuring the time of set of calcined gypsum has not yet come into general use, and is still subject to modifications. This study was undertaken to determine the effect of certain changes in the method of manipulation. It was found that the addition of excess water to the gypsum makes it set more slowly; that if the gypsum and water are mixed vigorously the set will be hastened; that the temperature of the water has nothing to do with the set.

Gypsum is now used for the manufacture of hollow tile and of reinforced roofs. Its inability to withstand the action of the weather limits its field of application. After a number of experiments a method of manufacture was evolved whereby gypsum tile may be produced, having, when compared with ordinary gypsum tile, three times the strength and three times the ability to resist erosion by water.

The tentative standard methods of test for calcined gypsum, as adopted by the American Society for Testing Materials in 1919, have not been used sufficiently to determine the numerical results which they will give. For example, it is not known what the tensile strength of a good gypsum should be, because so few samples have ever been tested by the standard method. For this reason, the bureau has undertaken to test about 100 samples of commercial products and to compile the results in such a way that the proper numerical values can be inserted in the specifications for these products. The tests include chemical analysis, water-carrying capacity, time of set, fineness, tensile strength, compressive strength and yield. This work is about 20 per cent completed by the Bureau of Standards.

Important Interestate Commerce Commission Decision on Crushed Stone Rates

Solvay Process Company Wins Reduction from 30 to 25 Cents per Ton on Nine-Mile Haul—Conditions, However, Are Somewhat Exceptional

A RAILWAY RATE DECISION of much significance to producers of mineral aggregates was recently decided by the Interstate Commerce Commission in the case of the Solvay Process Co. vs. the D. L. & W. R. R., and the Director General of Railroads.

The early history of this case and the intervention of Secretary of Commerce Redfield on behalf of a lower rate, were printed in ROCK PRODUCTS of March 29, 1919, page 50. The conditions of this case were, in some ways, exceptional, and one can hardly draw any conclusions on the results of this decision without a knowledge of all the details, which are given below, from the official record of the case:

History of Case

The complainant operates a large plant for the manufacture of soda ash and alkali products at the village of Solvay, which adjoins the city of Syracuse, N. Y., on the west. Limestone used in this manufacture is procured from complainant's quarry at Jamesville, N. Y., a point a few miles southeast of Syracuse, reached only by the line of the Delaware, Lackawanna & Western R. R., hereinafter referred to as the defendant, and is transported by defendant in carloads to complainant's plant at Solvay, a distance of about 9 miles. For some seven years prior to May 6, 1918, the rate charged for this service was 15 cents per long ton. On that date, following the decision in *The Fifteen Per Cent Case*, 45 I. C. C., 303, the rate was increased to 17 cents per long ton; and on June 25, 1918, under General Order No. 28 of the Director General of Railroads it was further increased by 1 cent per 100 pounds, or 22.4 cents per long ton. Under the rule for disposition of fractions, the rate thus became 40 cents per long ton. Complainant protested against this increase, and the rate was reduced to 1.5 cents per 100 pounds, or 30 cents per net ton, effective September 16, 1918, which is the present rate. By complaint filed December 17, 1918, these rates in excess of the former rate of 15 cents per long ton are attacked as unjust and unreasonable, in violation of the act to regulate commerce and of the federal control act. Reparation and just and reasonable rates for the future are requested.

The rates in issue, although applicable only to intrastate traffic, were initiated by the Director General of Railroads, and by section 10 of the federal control act, the duty of determining the justness and reasonableness of rates so initiated is laid upon this Commission. The Director General filed formal answer denying any violation of law, but was not represented at the hearing. A report proposed by the examiner was served on the parties. Exceptions were filed and the case was orally argued before the Division.

Some High Points

BY SUBMITTING DATA on what it cost the railway to move crushed stone a distance of nine miles, in cars owned by the shipper, the Solvay Process Co. was able to establish the fact that the railway company was earning a handsome profit on this traffic. The railway company attempted to depreciate the value of the alleged cost figures, but submitted none of its own in lieu thereof.

The Commission failed to agree with numerous assumptions of railway cost made by the quarry operator, but held that "a complainant's inquiry of the cost of service he receives, especially where rates are increased ostensibly to meet those costs, is entitled to serious consideration."

Comparisons with other crushed-stone rates were not admitted because there was no similarity in circumstances which entitled such comparisons to controlling weight.

The quarry owner proved that General Order No. 28 increased his freight rate 135 per cent.

The Commission held that the point at issue was not justification of a general rate advance, such as that under General Order No. 28, but the justice of its particular application in the case in question.

The Solvay Process Co. was awarded a reduction from 30 cents per ton to 25 cents per ton, effective February 14, 1920, and will be awarded a refund on the excess which it has paid and will pay before that date.

Influenced by Railway in Selection of Quarry Site

About 1909, complainant contemplated the acquisition of a site for a limestone quarry near Syracuse, and considered, among others, that at Jamesville. Preliminary to the selection and purchase, it corresponded with the defendant relative to the necessary transportation service and the charges therefor. It was at first proposed that the rate from Jamesville to Solvay should be 20 cents per long ton, the complainant to perform all of the switching at both quarry and plant, the defendant to furnish temporarily 20 cars, and the complainant to furnish any additional cars required. Defendant was to pay complainant 0.6 cent per mile for the use of such additional cars. Later, however, it was agreed that the complainant should furnish all of the equipment, without mileage compensation, and in consideration of this modification the rate was made 15 cents per long ton instead of 20 cents. Another available site with a limestone deposit was situated on the rails of the New York Central. Defendant contends that the rate agreed on was made with a view to the competitive situation.

The quarry was opened and shipments commenced to move in 1911. In addition to the kiln stone used at the Solvay plant, which is in large sizes, the quarry produces, as a by-product, smaller stone known as "spawls," and ground limestone. The latter products do not move to Solvay, and the rates thereon are not in issue. The production of kiln stone is about 75 per cent of the total. The traffic has greatly increased in volume, especially during recent years, as shown by the following table:

Year	Carloads	Net tons	Freight charges*
1911	1,825	95,461	
1912	8,624	453,727	$60,266.57
1913	8,682	456,241	61,140.35
1914	8,097	433,367	57,782.38
1915	9,591	528,095	70,584.32
1916	13,156	760,218	101,087.17
1917	15,037	879,457	118,560.22
1918	12,814	745,101	170,449.63

*These figures are based upon payments during the year and do not exactly correspond with the tonnage of that year.

Reasonableness of Rates Judged by Cost of Service

Complainant's investment at the quarry is upward of $1,000,000.

In preparation for the traffic defendant constructed sidings at Jamesville at an expense of about $7,000, and in 1915, better to accommodate its increasing traffic, constructed an additional main track between Jamesville and Syracuse at an expense of about $150,000. Defendant's witness testified that without complainant's traffic this additional track would not have been necessary.

The allegation of unreasonableness is supported largely by evidence bearing upon cost, and it is therefore necessary to consider the service with as much particularity as the record permits. The quarry and plant of the complainant are at opposite sides of the city of Syracuse, and the nine miles of intervening track comprises a portion of the main line of the defendant's Syracuse and Utica division. The line runs directly through the city of Syracuse and passes defendant's Syracuse yards, which are near the center of the city.

Under the present arrangement, a switching engine leaves the yards at about 4 a. m. and proceeds to Solvay, approximately 2.5 miles distant, where it picks up a string

of empty cars, already assembled on complainant's track. It hauls these cars to the yards and delivers them to a road engine and crew for the haul of approximately six miles to the quarry. The train reaches the quarry between 7 and 7:30 a. m., where the cars are placed on a siding. The engine and crew remain at Jamesville until about 10 a. m., spending, when necessary, about two hours of the interval in switching for other shippers. The engine then picks up a string of loaded cars already assembled on the quarry siding and proceeds with them to Syracuse and Solvay.

The train usually comprises 20 to 23 50-ton and 75-ton cars, loaded to capacity, and includes loads of spawls for Syracuse. The grade from the quarry to Syracuse descends about 57 ft. per mile for a distance of approximately five miles. To the westward of the Syracuse yards, the grade ascends toward Solvay about 30 ft. in a distance of one mile. It is estimated that one-half of the trains require the help of a "pusher" engine at this point. After placing the loads at the complainant's siding at Solvay, the engine immediately returns to the quarry with another train of empties, which it exchanges for loads, leaving the quarry the second time between 4 and 4:30 p. m. After delivering these loads at Solvay it returns to the yards light. While the traffic was heaviest this operation proceeded on Sunday as on other days, but at other times only one trip has been made on Sunday.

According to the defendant, the regularity and time of movements were insisted upon by the complainant, but the latter maintains that the convenience of the carrier was also considered, in that the movements were so timed as to interfere least with the passenger traffic. It is alleged by defendant that complainant's traffic is given right of way through Syracuse and that other traffic is sometimes delayed in consequence.

Equipment Owned by Quarry Owner—Does Own Switching

Owing to the contribution of equipment and the performance of terminal services wholly by the complainant, the shipment is unique in character, and the determination of a proper maximum charge for the carrier's service offers unusual difficulties. The former assistant general freight agent of the defendant, who had much to do with the negotiations establishing the rate of 15 cents per long ton, testified that in arriving at the rate defendant considered the probable volume of traffic, the manner of handling, the saving of terminal service at Jamesville and Solvay, the cost of construction of tracks, the matter of furnishing equipment, and, in as much detail as practicable, the total expense to the carrier. The allowance of 5 cents per ton in consideration of the furnishing of equipment by the shipper was based upon an assumed investment of $100,000, an equipment life of 10 years, and interest upon capital at 6 per cent. It appears, however, that the complainant's investment in the equipment used in this service has not at any time reached $70,000. This witness, who left defendant's service in October, 1917, testified that the results of the arrangement had fully met expectations and that the traffic had been regarded as very profitable to the carrier. He had not given the matter specific attention since 1916. No increase in the rate upon this traffic was made by the carrier when the 5 per cent increase on interstate traffic was authorized in the supplemental report in *The Five Per Cent Case*, 32 I. C. C. 325.

Arriving at Cost of Service

Complainant made an attempt, by questioning defendant's employees and by calling for information from defendant's records, to establish the cost of the service involved. Upon this information, gleaned from witnesses, from statements filed after the hearing, from the defendant's annual reports to the Commission, and from other sources, complainant bases an argument that the former rate of 15 cents per long ton was high in comparison with the costs attributable to the particular traffic. The period selected was the calendar year 1918. The methods employed and the results may be summarized as follows:

Wages of train crew—In response to complainant's request, defendant filed a statement showing the actual payments of wages to the road-engine crew employed in the service for the months of January, May, and October of each of the years 1912 to 1918, inclusive. The amount stated for those months of the year 1918 is $3,446.98, from which complainant estimates the total for the year at $13,787.92. Inasmuch as the crew was employed about two hours of each day in other switching, nine-elevenths of $13,787.92, or $11,281.02 is assigned to the stone traffic; and as, during 1918, only about 84 per cent of the stone traffic was moved to Solvay, complainant concludes that 84 per cent of $11,281.02, or $9,476.05 is chargeable to its traffic.

Engine costs—Complainant requested of defendant a statement of the cost of fuel, oil, water, and other supplies furnished the engine used in the service for the years 1912 to 1918, inclusive. In response to this request, defendant filed a statement of the average of such costs per engine-mile for all its engines, both passenger and freight, for the years 1912 to 1917, inclusive. These items for the year 1917, which are higher than for any other year, aggregate 25.75 cents. Complainant computes the mileage of the engine as 36 miles per day, or 13,140 miles for the year, from which it deduces a total cost of $3,383.47 for the year, 84 per cent of which, or $2,842.11, is attributed to complainant's traffic.

Wages of gatemen and flagmen—According to defendant's statement, the amount of wages of gatemen and flagmen employed on the line between Jamesville and Solvay for the months of January, May, and October, 1918, was $8,862.27, from which complainant estimates that the total payments for the year amounted to $35,449.08. Complainant assumes that about three-fourths of this amount, or $26,586.81, is chargeable to freight traffic, the basis of this assumption being that about three-fourths of defendant's total transportation revenue is derived from freight traffic. Complainant assigns 11.3 per cent of this $26,586.81, or $3,004.31, as the amount chargeable to the particular traffic here involved. The ratio of 11.3 per cent is thus explained: In response to a request from the complainant for a "statement of the number of cars handled on the Delaware, Lackawanna & Western through the Syracuse yard in the months of January, May and October in each of the years 1912 to 1918, inclusive," defendant filed only a statement of the "number of cars arriving Syracuse yard, Year of 1918. The number thus shown is 112,782, from which complainant concludes that its traffic for the same year, 12,814 loaded cars, constituted 11.3 per cent of the total.

Maintenance-of-way — Defendant's witness testified that the cost of maintenance of the main tracks here involved, for the year 1918, was $1,434.10 per mile, which, applied to the total of 13.62 miles of such tracks, amounts to $19,534.44. Applying to this amount successively the ratios of 75 per cent to segregate freight expense and 11.3 per cent to segregate the expense attributable to complainant's traffic, yields a final figure of $1,655.37 as the allowance for maintenance of main tracks. According to the same witnesse, the cost of maintenance of complainant's siding was $593.73 per mile, or $866.84 for the total length of 1.46 miles. The total of maintenance-of-way costs chargeable to complainant's traffic as thus computed is $2,522.21.

Maintenance of engine—Defendant expressed inability to state the costs falling under this head, and complainant estimates the amount of $2,000, taking into consideration the cost of the engine, $17,019.36, and the proportion of its service in hauling complainant's traffic.

Other expenses—In the absence of information requested of defendant, complainant assigns, under this heading, an amount of $2,000 to cover superintendence, station expense, etc.

Taxes—The average amount of taxes per mile of road paid by defendant for the year 1918 is stated at $3,744.49. Complainant multiplies this amount by 15, which is the number of miles of defendant's track used in this traffic, and applies to the product the ratios of 75 per cent and 11.3 per cent, already explained, arriving at $4,760.17 as the amount of taxes assignable to its traffic.

General expense—Defendant was requested by complainant to state its average general expenses per mile of road, but filed instead an apparent total for the system amounting to $295,914 for the months of January, May, and October, 1918, from which complainant estimates defendant's general expenses for the year at $1,183,656. Complainant then referred to Moody's Manual to ascertain defendant's total trackage, and by using the figures there given, 2,652 miles, reached an average expense per mile of $446, or $6,690 for the 15 miles involved. Again using the ratios of 75 per cent and 11.3 per cent, complainant arrives at $566.97 as the amount of general expenses chargeable to its traffic.

The items of cost thus arrived at aggregate $27,171.82, from which complainant concludes that the total cost to the carrier of handling the traffic here in question during the year 1918 could not possibly have exceeded $30,000, against which is shown an actual gross revenue of $170,449.63. The revenue at 15 cents per long ton would have amounted to $100,760.

Railway's Profits on Stone Business Estimated

Complainant also compares this revenue with the total investment, allowing $17,019.36 as cost of engine, $7,000 as investment in sidings, and $270,000 as estimated in nine miles of track, which is used for other traffic as well as complainant's and reaches the conclusion that a rate of 15 cents per long ton, after allowing 12 per cent for interest and depreciation, would have covered the total cost of service and yielded a profit of $35,000. It is also pointed out that the ton-mile earnings of this traffic, about 1.49 cents at the 15-cent rate and 2.98 cents at the 30-cent rate, are far in excess of the average for all of defendant's freight traffic, which, for the year 1918, was 9.02 mills.

The numerous assumptions resorted to by the complainant are not in all cases warranted, nor are the deductions always rea-

sonable. For example, if the number of cars reported by defendant as having arrived at its Syracuse yards during the year 1918, 112,782, includes empty cars as well as loaded cars, it is obvious that complainant's deduction that its traffic constitutes 11.3 per cent of the total is incorrect. The average length of haul is greater than on the traffic in question. Nor is it at all apparent that complainant's cars should take the average basis. This ratio affects several of the principal items of cost. Engine-miles incident to the trips from yard to plant and return are omitted, as is also the expense of the service of the yard engine and "pusher" engine. The allowance of $2,000 for maintenance of the road engine used is considerably below the average cost of engine repairs alone, without consideration of depreciation. The method of arriving at the amount of general expense is of questionable accuracy and unauthorized by the record, but the character of movement and traffic indicates that the cost other than that directly connected with the movement of the trains is relatively low. Further criticism of complainant's methods might be made, but it does not follow that its conclusions should be regarded as wholly without significance.

Taking the figures of cost, so far as produced, together with other evidence of record, it seems probable that the traffic here involved, under the rate charged prior to May 6, 1918, was at least as profitable to the carrier as was its other carload freight traffic in general. During the year 1918 the average loading of complainant's cars was approximately 58 net tons, which at the rate of 30 cents per ton would have yielded a revenue of $17.40 per car.

Defendant made no affirmative showing of cost of service, but on brief expressed the hope that the Commission would not "give effect to any ill-considered or fragmentary cost figures or to figures based on inadequate study and on general average statistics." It seems appropriate to remark that a complainant's inquiry as to the cost of the service he receives, especially where rates are increased ostensibly to meet those costs, is entitled to serious consideration.

Defendant further contends that the rate of 20 cents originally offered by the carrier was influenced by the fact that complainant was then considering a quarry site on the New York Central, and that the reduction of 5 cents per ton in consideration of the furnishing of equipment by the complainant was excessive. In support of the latter contention the following computation was submitted:

Total investment in cars never exceeded (Ex. 6 and statement filed since hearing by witness Manning.)	$66,350.47
Interest at 6 per cent for 10 years	39,810.26
Investment and interest	106,160.73
Tons carried, 7 years	4,351,667
Tons carried, 3 years (estimated)	2,384,776
Total net tons	6,736,443
Equivalent to 6,014,681 long tons, which, at 5 cents per ton, would amount to	300,734.05
Surplus after paying total purchase price of cars with 6 per cent interest available for maintenance, etc.	194,573.32

However, an allowance of 6 per cent for return upon investment and for maintenance other than depreciation is presumably insufficient. Moreover, the consideration for the 5-cent reduction is not here fully accounted for. As already stated, the originally proposed rate of 20 cents contemplated the payment of mileage on complainant's cars. The true consideration was thus stated by defendant's vice president in a letter to complainant's president, dated November 29, 1909:

> In going over this matter again on the basis of your providing all the equipment from the start, it seems to us that a reduction of 4 cents per gross ton in the rate, that is, from 20 cents to 16 cents, would be, all things considered, an equitable adjustment.
>
> We feel, however, that we would rather be relieved of the burden of paying per diem, keeping the records, etc., and are prepared to name rate of 15 cents per gross ton on this traffic without the payment of mileage and with the understanding that you furnish all equipment necessary to handle the traffic.

Attempt Comparisons with Other Crushed-stone Rates

Both parties submitted comparisons of the rates in issue with those charged for the transportation of stone at points more or less remote from Syracuse, but, apart from the movement from Oxford Furnace, N. J., to New Village, N. J., there is no such showing of similarity in circumstances as entitles the comparisons to controlling weight.

Defendant offers no defense of the 40-cent rate, which was in effect from June 25 to September 16, 1918. The reason for the change to 30 cents, effective on the latter date, is not shown of record, but counsel for the defendant assumes that the rate was reduced in recognition of the contributions of service by the complainant. In defense of the present 30-cent rate, defendant cites the act of August 29, 1916, the President's proclamation of December 26, 1917, the federal control act, and the recital of General Order No. 28.

General Order No. 28 Meant 135 Per Cent Increase

These recitals tend, however, to justify the rate increases under that order as a whole and not necessarily the increase in every rate. The order provided in general for an increase of 25 per cent in freight rates, but the rates on certain commodities, including that here involved were increased by specific amounts regardless of distance or volume of the rate increased. The increase of 1 cent per 100 pounds on complainant's traffic amounted to about 135 per cent of the former rate. Had the rate been $1 per ton instead of 17 cents, it is apparent that the increase would have been but 22.4 per cent. The present rate of 30 cents per net ton represents an increase of approximately 100 per cent.

It appears that complainant's traffic manager, under date of June 6, 1918, addressed the director of traffic of the Railroad Administration protesting against the proposed increase of 1 cent per 100 pounds on his traffic and asking that it be limited to 25 per cent instead. When General Order No. 28 was promulgated, an immediate increase of revenue was doubtless deemed imperative. It is not, however, to be presumed that there was any intent permanently to abandon the standards by which the rights of individual shippers had been determined during a period of peace. It is rather to be presumed that the constituted authorities had in contemplation ultimate readjustment in cases where the universality of their methods might be shown to work undue hardship upon particular shippers. It is unnecessary to consider here the justification for the general increases in rates; the question concerns the specific increase applied to what is an almost unique movement of this particular traffic.

The Secretary of Commerce was represented at the hearing and has filed a brief supporting generally the contentions of the complainant, but urging in addition the power and primary duty of the Railroad Administration to foster and protect commerce, with only secondary regard to the adequacy of rates as sources of revenue. He differentiates in this regard between federal and private control, pointing to the fact that the Railroad Administration is given the support of public funds derived from general taxation. He urges also the importance of relieving complainant's traffic from any unnecessary burden, in view of the utility of its products and their wide distribution. However, in considering its powers and duties under the federal control act in reviewing rates initiated by the Director General, the Commission has concluded that the words "just and reasonable," as used in that act, have substantially the same meaning as in the act to regulate commerce, from which they are drawn. *Willamette Valley Lumbermen's Asso.* v. *S. P. Co.*, 51 I. C. C., 250, 258.

Upon all the facts of record, we find that the rates charged by defendants for the transportation of complainant's shipments of limestone in carloads, from Jamesville to Solvay, moving after June 25, 1918, were, and that the present rates, are, and for the future will be, unjust and unreasonable to the extent that they exceeded or may exceed 25 cents per long ton. An order to this effect will be entered. We further find that since June 25, 1918, complainant has made numerous shipments from Jamesville to Solvay, as described, and has paid and borne the charges thereon; that it has been damaged to the extent of the difference between the charges paid and those that would have accrued at the rate herein found just and reasonable; and that it is entitled to reparation, with interest. The amount of reparation due should be determined in the manner provided in rule V of the Rules of Practice, and when so determined the entry of an order for reparation will be considered.

No. 10363.

Solvay Process Company

Order Issued

This case being at issue upon complaint and answers on file, and having been duly heard and submitted by the parties, and full investigation of the matters and things involved having been had, and said Division having, on the date hereof, made and filed a report containing its findings of fact and conclusions thereon, which said report is hereby referred to and made a part hereof:

It is ordered, That the above-named defendants be, and they are hereby, notified and required to cease and desist, on or before February 14, 1920, and thereafter to abstain, from publishing, demanding, or collecting their present rate for the transportation of limestone, in carloads, from Jamesville, N. Y., to Solvay, N. Y.

It is further ordered, That said defendants be, and they are hereby, notified and required to establish, on or before February 14, 1920, upon notice to this Commission and to the general public by not less than 30 days' filing and posting in the manner prescribed in section 6 of the act to regulate commerce, and thereafter to maintain and apply to the transportation of limestone, in carloads, from Jamesville, N. Y., to Solvay, N. Y., a rate not in excess of 25 cents per long ton.

And it is further ordered, That this order shall continue in force for a period of not less than two years from the date when it shall take effect unless meantime otherwise ordered.

Big Growth in Export Trade in Cement

Export Shipments Increasing Notwithstanding Higher Prices

WASHINGTON, D. C.—The end of the war has resulted in a great increase in the production and export of cement, according to a report just prepared by the division of statistics of the bureau of foreign and domestic commerce.

If exports of hydraulic cement from the United States continue until the end of 1919 at the rate shown for the first three-quarters, the total for the calendar year will exceed 2,386,000 bbls., valued at $7,367,000, constituting the high record with regard to values.

The war cut off imports of cement from European countries into the United States, but increased both domestic production and exportation. The exports consist chiefly of Portland cement and are only a small percentage of the total domestic production. The quantity exported in 1914 was 2.4 per cent and in 1915 less than 3 per cent of the total production of hydraulic cement in those years, 2.7 per cent in 1916 and 1917, and 3.1 per cent in 1918. The increase in exports since 1915 is chiefly due to a gain in the South American and West Indian trade in this commodity.

Imports, Exports and Production

The imports, exports, domestic production, and average annual import and export prices for for the calendar years 1914 to 1919 are shown below, the "barrel" used in this tabulation being one of 376 pounds:

Calendar years	Imports Cwt.	Imports Value	Exports Bbls.	Exports Value	Domestic production, bbls.	Average price Import, per cwt.	Average price Export, per bbl.
1914	463,078	$193,155	2,140,197	$3,088,800	89,049,766	$0.417	$1.44
1915	160,390	57,149	2,565,031	3,361,451	86,708,448	.356	1.31
1916	6,855	4,924	2,563,976	3,828,231	92,363,335	.718	1.49
1917	8,829	6,075	2,586,215	5,328,536	93,453,658	.688	2.06
1918	1,146	1,185	2,252,446	5,918,166	71,514,629	1.03	2.66
1919 (9 months)	31,807	50,795	1,789,612	5,525,351	.....	1.60	3.09

A glance at the following table will show how the foreign-trade figures for January-September, 1919, compare with those for the first nine months of the preceding five years:

January-September	Imports Cwt.	Imports Value	Exports Bbls.	Exports Value
1914	398,932	$169,425	1,622,300	$2,344,900
1915	146,979	51,820	2,039,477	2,662,885
1916	6,221	4,058	1,989,751	2,894,754
1917	4,045	4,434	1,817,169	3,613,582
1918	868	931	1,761,549	4,428,941
1919	31,807	50,795	1,789,612	5,525,351

Import Trade Cut off During War

With the exception of small amounts from Canada, the import trade was practically cut off during the war, but it had been declining for a number of years preceding the outbreak of hostilities in 1914. For 20 years prior to 1907 the average annual importation of hydraulic cement exceeded 2,000,000 bbls. (of 376 pounds net), which was followed by a drop in the annual receipts until 1912, the returns for that year amounting to 68,503 bbls; 84,470 bbls. were received in 1913, and 120,906 bbls. (459,443 hundredweight) in 1914.

With the outbreak of the war receipts of imported cement declined—from 160,390 hundredweight in 1915 to 6,855 hundredweight in 1916, 8,829 in 1917, and 1,146 hundredweight in 1918, the bulk of this cement, as already stated, coming from Canada. Of the 31,807 hundredweight, valued at $50,795, imported during the nine months ending September, 1919, 26,880 hundredweight, invoiced at $48,000, or $1.80 per hundredweight, came from Austria-Hungary.

The reduction in the American imports of cement during recent years can be attributed in part to the increased output at low cost of the domestic industry. In 1914 Portland cement was manufactured in 110 plants scattered throughout the States at an average factory price per barrel in bulk of $0.927, and in 1915, at $0.86 per bbl., in 106 factories, according to statistics compiled by the United States Geological Survey. The average import price was $0.417 per hundredweight in 1914, but dropped to $0.356 in 1915; in 1916 it was $0.718, in 1917, $0.688, in 1918, $1.03, and in January-September, 1919, it rose to $1.60.

Brazil the Leading Purchaser of American Cement

The bulk and weight of cement, coupled with the necessity for keeping it dry, make transportation costs for long distances excessive as compared with the value of the product itself; hence cement is not the most desirable commodity in foreign trade. But that it can be shipped long distances and marketed profitably in foreign countries is evidenced by exports of American hydraulic cement amounting to 1,789,612 bbls. to 51 countries during the nine months ending with September, 1919. The average annual exportation of cement from the United States during the four years of the war (1915-1918) was nearly 2,500,000 bbls., notwithstanding a rise in value from $1.44 per barrel in 1914 and $1.49 in 1916 to $2.06 in 1917, and $2.66 in 1918. In the part-year 1919 there was a further advance to $3.09.

During the first three quarters of the current year Brazil has been the leading purchaser of American cement, taking 488,000 bbls., valued at $1,503,000, followed by Cuba, with 333,000 bbls., worth $1,016,000; Argentina, with 314,000 bbls., invoiced at $936,000; Mexico, with 97,000 bbls., worth $314,000; Panama, with 94,000 bbls., valued at $226,000; Peru, with 62,000 bbls., invoiced at $201,000; Colombia, with 55,000 bbls., worth $178,000; Chile, with 45,000 bbls., worth $154,000; and the Dominican Republic, with 43,000 bbls., valued at $146,000. Shipments of 11,600 bbls., worth $39,000, were made to distant Madagascar in January.

*The import prices are the wholesale prices in the country from which imported, and do not include ocean freights, insurance, and other transportation charges. The export prices are the prices at the port of the United States from which the cement is shipped.

Illinois Sand and Gravel Plant Preparing for Increased Production

IN ANTICIPATION of a large business next year, the Rockford Sand and Gravel Co., Rockford, Ill., is increasing the capacity of its plant.

Until this fall the gravel pit has been operated by a drag-line, but now a 300-ft. belt conveyor from the bottom of the pit to the top of the screening tower is being installed to replace the old method.

Since the deposit at Rockford is largely sand, the excavation will be done by a sand digger above the water-line and a floating dredge will remove material below the water-line. It is estimated that the 12 in. motor driven direct connected pump of the dredge will pump about 30 carloads of material per day to the plant, and that the digger will furnish almost as much.

S. A. Gibson, secretary of the company, states that the prospects for a big 1920 year of business is darkened only by the labor question. On this amount 1920 prices are very uncertain.

Molding Sand Discussed by a Producer

Requisites of Molding Sands for Iron and Steel, and Why

THE CUMBERLAND SAND CO., Millville, N. J., (main office in Philadelphia) has issued an interesting and instructive booklet entitled "Proof—Supply of Strong Silica Molding Sand with Natural Binder for Heavy Steel Casting Not Exhausted." It is one of the first expositions of molding sand practice to come from a producer of sand, and represents much research work for information of value to the producer of molding sand, as well as the user—the foundry man. What follows is an abstract of that part of the booklet which is of general interest to all sand producers.

Requisite Qualities

A sand which possesses qualities which enable it to be tempered and formed to definite shapes, which it will retain when molten metal is poured in it, which has the chemical composition to enable it to resist fusion from the heat of the molten metal, which also has sufficient permeability to permit the free escape of gases from the mold while it is filled with metal, without scabbing or otherwise injuring the surface of the mold, is what is termed molding sand.

There are four principal elements requisite in a good molding sand; viz., (A)—Resistance to fusion; (B)—Bond; (C)—Permeability; (D)—Porosity.

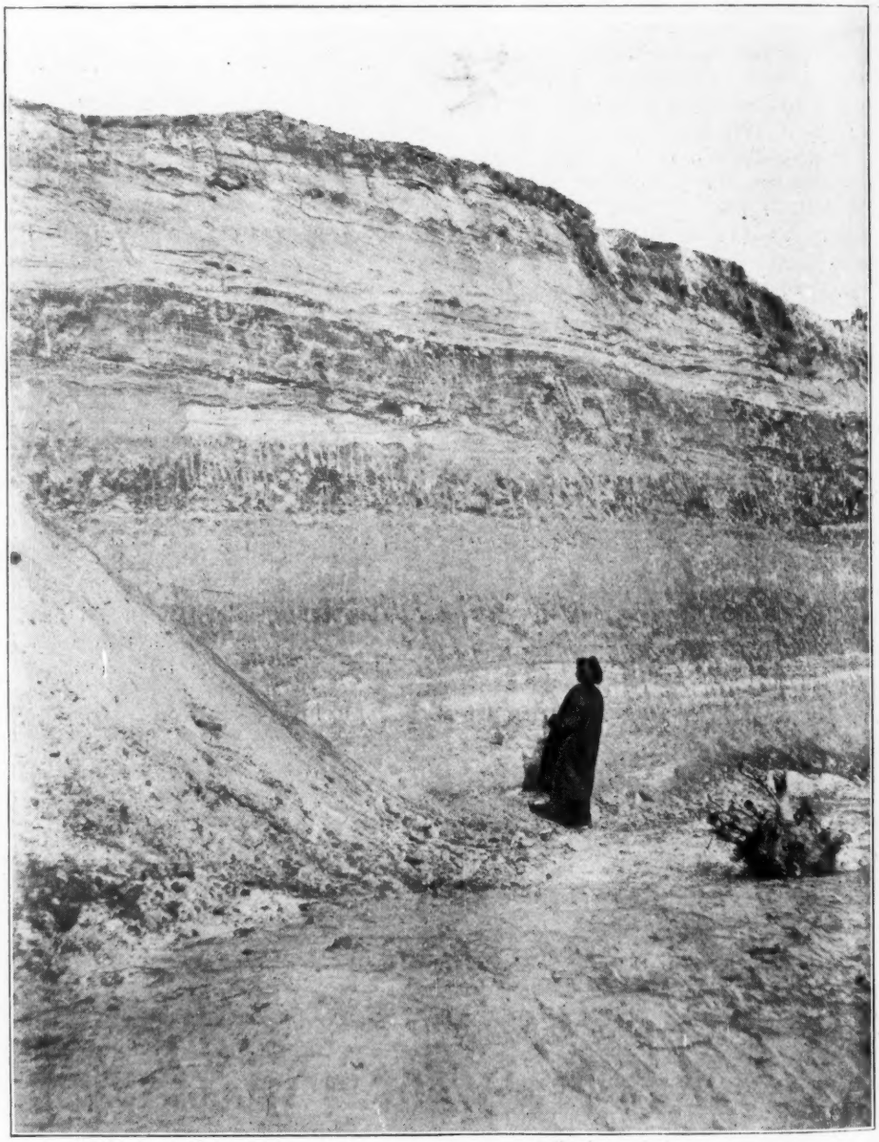
Explanation of Elements

(A)—Fusion is the act of being dissolved by heat and it is the opposite that is desired in a molding sand; resistance to fusion is therefore highly important. The experienced foundryman is constantly on the alert to secure a sand which is free from agents which will materially aid fusion. Lime will lower the power of the sand to resist fusion, and when present as a silicate, it will combine with the silica and alumina of the sand under the action of the heat of the molten metal, and will vitrify and form a scale on the casting.

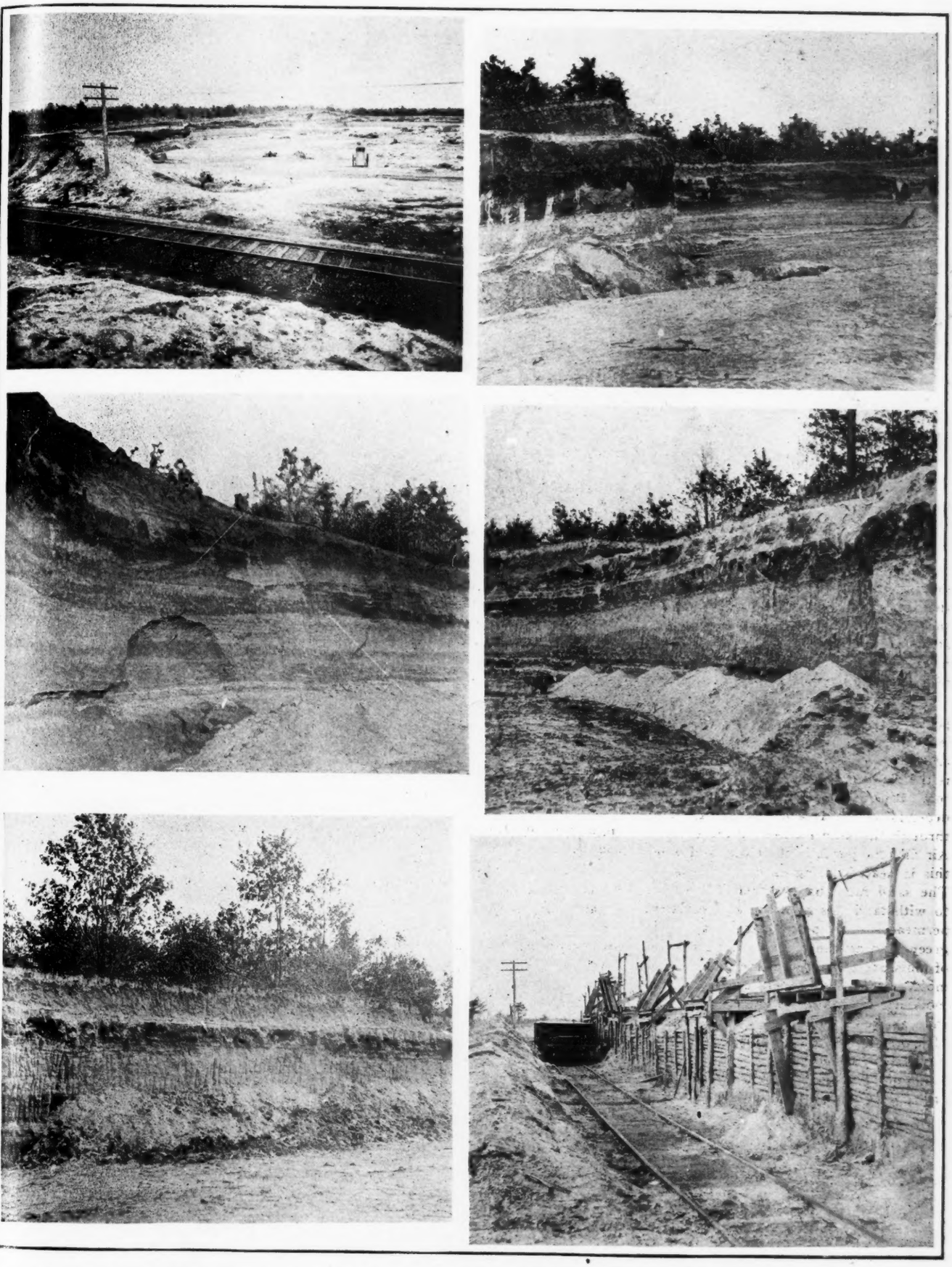
(B)—Bond is anything that binds and is necessary in molding sand because air fills the pores of the molds, and when heated during the pouring of the metal, it expands. To resist the pressure due to the expansion, the sand must have cohesion or sufficient bond to enable it to "stand up" in the mold. Then, too, while the metal is poured, parts of the mold are subjected to a "washing away" by reason of the flowing metal, and sufficient bond is necessary to prevent serious wear from this cause. So great is the danger of wearing away where the metal first strikes the mold, that it is sometimes necessary to reinforce it by mechanical means.

Molds of intricate form require a sand with stronger bond than those of simpler form. In such cases other materials than natural bond are resorted to, such as clay, molasses, linseed oil and other sticky substances to give the sand the desired tenacity. These various substances are termed artificial bond. To avoid the expense of artificial bond, a molding sand with a high percentage of natural bond is preferred.

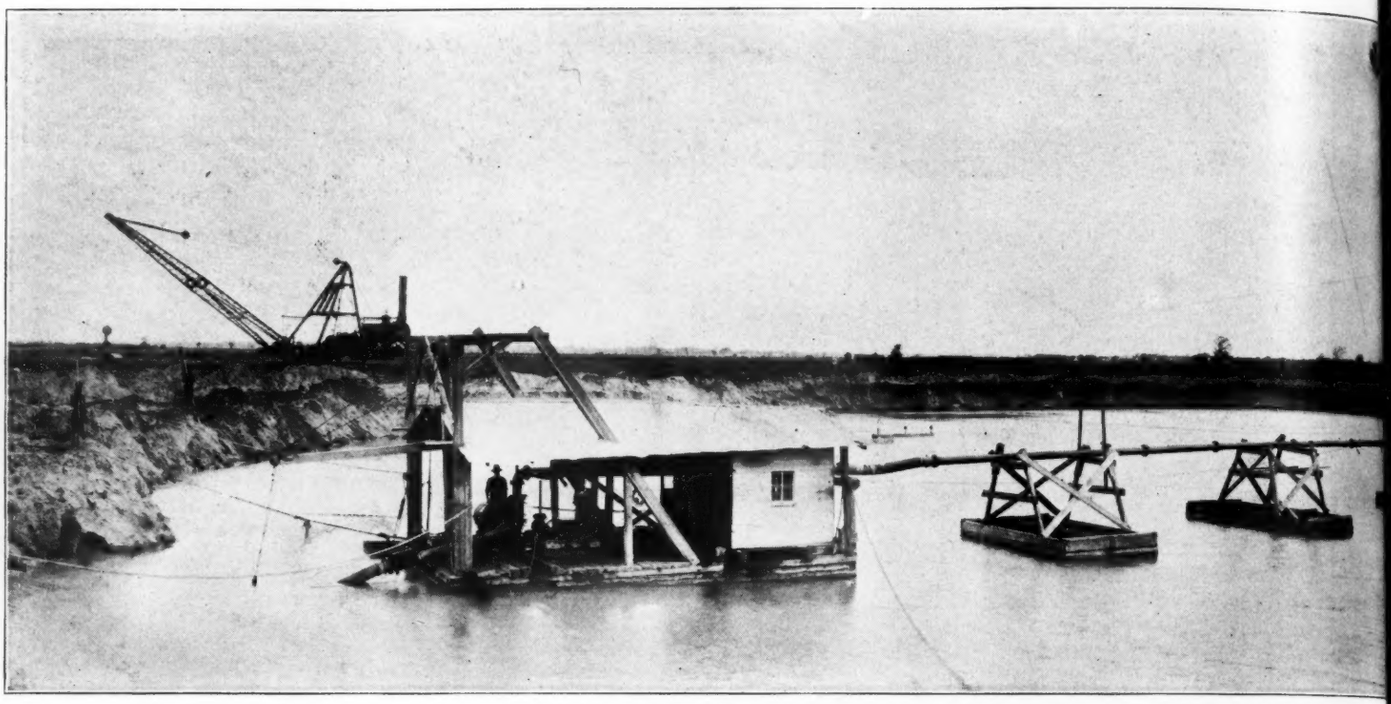
It is well known that angular grains of a clayey sand cohere more or less firmly when the mass has been squeezed and dried. A highly heat resisting clay adhering to and uniformly permeating a sand constitutes a natural bond prized so highly by the molder. There are various methods of testing the bonding strength of a molding sand, all of which are treated under technical experiments, and are of varying importance in accordance with the method of molding followed, and are dependent chiefly upon the clay content, the amount of water used in tempering, and the amount of tamping, as well as the shape of the grains. In any event, the chief factors are the composition of the sand and the amount of ramming in the mold.



Bank on property of Cumberland Sand Co., Millville, N. J., showing natural binding properties



Various views of the Millville deposit of the Cumberland Sand Co., of Philadelphia, showing simple methods of development and shipping



Sand and gravel development by combination of hydraulic dredge and shore [illegible] **dragline**

(C)—Permeability is the state of being permeable, or as applied to molding sand, the ability of permitting the passage of the gases through it, which are generated in the molds while filling with metal, and is a most important quality of a molding sand.

(D)—Porosity is the quality of having pores, which is necessary in molds. There is a difference between the permeability and porosity of a molding sand. Porosity is the ratio of voids or pore space to the total volume of the sand: Permeability depends on the area of the passageways through the sand formed by these voids. Air fills the pores in the mold, and when this is heated during casting, it expands. The sand must have sufficient cohesion to withstand this pressure and sufficient permeability to permit its escape. In green sand molding, there is a percentage of moisture contained in the pores of the mold. Steam is generated from this moisture in casting ,and this must escape as well as other gases often given off from the molten metal. If these various gases cannot easily escape through the mold or core, blowholes will result and the casting will be injured.

There are various methods in use to secure the desired permeability, such as using wisps of straw or punching fine holes in the mold, and by mixing different grades of sand. In a mixture of clean, sharp, coarser sand with a finer clayey material, the former makes the mold permeable while the latter gives the desired bond.

From the experiments of King* it has been deduced that (1) pore space can be reduced by tamping, but the theoretical minimum of 25.95% can rarely be reached; (2) under equal treatment, mixed sands of different grain diameters give lower pore space than do sands of uniform grain, degree of rounding being the same; (3) angular sands have more space than rounded sands, other things being equal; (4) the least pore space may be expected when the grains are about equally divided between large and small, with no intermediate sizes. It is evident that the closer the packing of the grains, the less the permeability, and angular sands are more permeable than rounded.

By chemical analysis may be determined the amount of bond and its resistance of fusion, but it does not determine whether a good casting can be produced with a certain sand.

Microscopic tests are also necessary, as these will reveal the shapes of the grains of sand, whether flattened, rounded, or angular, which in turn determines how closely the mold can be rammed and still permit the gases, generated in pouring, to escape. A sharp angular grain is of the utmost importance, since with this grain the sand can be firmly rammed around the pattern and yet give a porous and permeable mold.

.With a strong open sand, a less experienced molder will often make a better casting than will the more experienced molder, using a sand lacking in permeability. A molding sand with grains nearly round, while making a good mold, requires more attention than the other.

The refractoriness of sand depends upon its silica content, but the bond decreases as the silica increases.

The following are typical analyses* of molding sand for steel castings as used by steel foundries producing large tonnage of castings at this time:

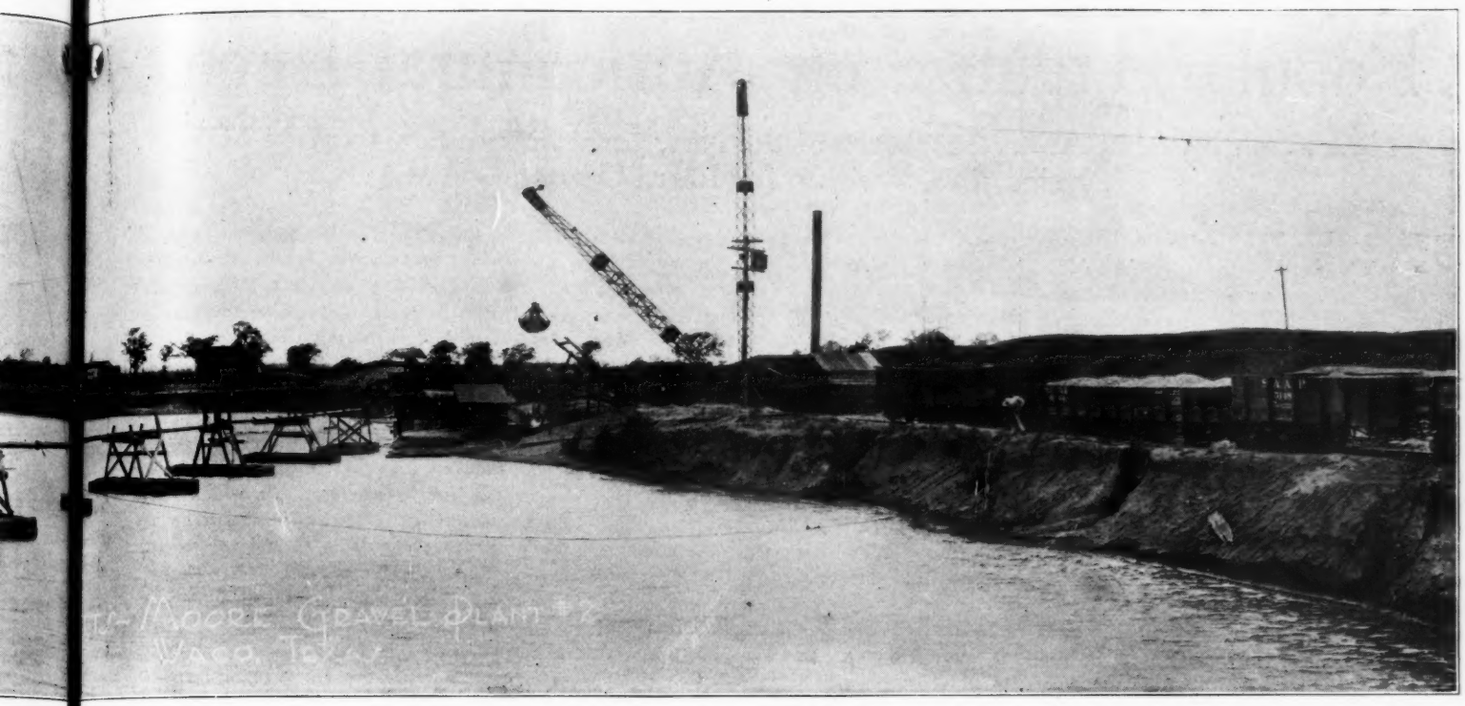
First Model Analysis:	
Silica	98.5 %
Alumina	1.40%
Iron Oxide	0.06%
Lime	0.20%
Magnesia	0.16%
Combined water	0.14%
Alkalies	0.25%
Second Model Analysis:	
Silica	92.03%
Alumina	3.59%
Iron Oxide	2.24%
Lime	0.40%
Magnesia	0.50%
Alkalies	1.10%
Third model analysis:	
Silica	87.25%
Alumina	7.15%
Iron Oxide	2.32%
Lime	0.03%
Magnesia	0.25%
Alkalies	0.13%
Fourth Model Analysis:	
Silica	82.21%
Alumina	9.48%
Iron Oxide	4.25%
Lime	Trace
Magnesia	1.18%
Alkalies	0.78%

Steel is a more difficult metal to cast than iron, because the shrinkage is greater, being about ¼ in. per ft., while iron is only about ⅛ in. per ft. Steel has also a shorter period of fluidity and expels a greater quantity of gas.

Molds for steel castings are made much in the same manner as for iron castings, except two principal differences, the first being the quality of the sand used, which must be a highly re-

*Nineteenth Annual Report of the Director of the U S. Geological Survey, II, Pages 209-215.

*These analyses were furnished by the superintendent of a steel foundry having a large and varied tonnage output.



dragline for stripping operations—Potts-Moore Gravel Co., Waco, Texas

fractory mixture and must have a certain amount of bonding material to hold it together while the mold is being made, finished and baked. The second difference is in number and size of shrink heads and risers. The great shrinkage of steel in cooling from the liquid to the solid state requires risers of liberal proportions to be provided over the massive portions of the castings to act as reservoirs of steel to supply the casting with liquid metal as it shrinks in the mold; if these are not provided cavities result.

Life of Sand

After a sand has been used, it loses some of its desirable qualities and is less fit than when fresh. With continued use it becomes "dead," and is useless. The length of life of a sand is variable, depending upon the sand itself and the nature of the work.

By repeated exposure to the heat of the casting, particularly where large castings are made and the heat is lost slowly, the combined water in the clay is driven off and the clay constituent of the sand loses its plasticity. Analyses of the same sand, before and after use, show that the only essential difference is in the amount of combined water present, the "dead" sand containing practically none. Hence it is concluded that the dehydration of the clay is the chief reason for the sand becoming "dead." It is economy to use a sand which deteriorates slowly. A high silica content of sand, and absence of iron and lime in objectionable quantities, enable the foundryman to re-use a higher percentage of the refuse or used sand.

Texas Sand & Gravel Plant Layout

(Not Patented)

Combination Dredge and Shore Plant Operated by the Potts-Moore Gravel Co., Waco, Texas

SIR—Noting the article on page 23 of your issue of September 27th, describing gravel plant designed by Delbert Wheeler of Le Mars, Ia., we thought perhaps the view of our operation shown herewith would prove of interest. This plant has been in operation on substantially the same methods since early in 1914. The photograph was made on May 25, 1918.

It will be seen that the dredge is driven by an electric motor; that the discharge passes directly through a jacketed cylindrical screen; that the materials pass thence into sumps alongside the track and are reclaimed for loading or storage by a 1½-yd. clam shell operated by the derrick; that the water and silt run off from these sumps to the lake; and that we load two cars at different points on the circle, one for gravel and one for sand.

No storage is shown in the picture but we have frequently had large piles on each side of the boiler house on the opposite side of track from the screens.

Only two sizes of gravel and one size of sand are made. The plant would not be practicable for more thorough sizing. We have no over size.

The stripping is done with a Monaghan drag-line excavator, and the material thrown into the lake. It is necessary to strip only a narrow space each time in order to leave plenty of free water and not ground the dredge. This, of course, must be done every few days and not once a year as Mr. Wheeler seems to intimate.

About the only differences we see between our plant and Mr. Wheeler's plan are that we use a cylindrical screen instead of conical; have two gravel sumps like his sand sumps; use a derrick instead of a crane; put the track between the derrick and the screen; and use a separate machine for stripping which is absolutely necessary if one is handling any considerable volume of stuff.

There are a number of other plants in this section of the country operating more or less on this same principle. Our own plant has been visited by a good many men from both within and without the state, the last one yesterday, and we have always made them welcome to any ideas they might pick up.

If Mr. Wheeler's ideas on the plant are only theoretical at present, we can assure him that the scheme will work very nicely, even though it should prove to be not patentable by him on account of its lack of priority.

POTTS MOORE GRAVEL CO.
Per Robt. J. Potts, President.
Waco, Tex., October 4, 1919.

Popular Treatise on Agricultural Lime

New Book by Alva Agee, Secretary of the New Jersey State Department of Agriculture, Written for Farm Owners

UNDER THE TITLE "Right Use of Lime in Soil Improvement," Alva Agee has written an interesting 90-page volume designed for the average farmer. It bears every evidence of an honest and conscientious attempt to present in a small compass the sum total of a great many independent reports from Agricultural Experiment Stations and other authorities on the use of lime in agriculture. It is published by the Orange Judd Co., New York, among the foremost agricultural publishers of the country, and will doubtless receive a very wide circulation among farmers.

For this reason alone it is of considerable interest to the producers of lime and ground limestone. On the whole it is believed that the book will do the lime and limestone industry an immense amount of good, by presenting the farmer in popular, unscientific, yet fairly accurate terms the reason why he must use lime in some form or other, if he would make farming pay.

In his introductory chapter, after depreciating the confusion created by the claims of rival producers of liming materials, the author concludes: "Lime cannot take the place of nitrogen, nor phosphorus, nor any other of the essential plant foods. It is not a substitute for any other essential factor in plant growth. It would be folly to try to depend upon lime as a sole source of soil fertility. On the other hand, we have learned very definitely within the last quarter of a century that it is foolish to depend upon commercial fertilizers and tillage and good seeds for full production of most crops from great areas of our farming country that have a marked lime deficiency. The obvious need of our soils is the rich organic matter that clover and grass sods could furnish, and *their* fundamental need is lime. Most farms cannot possibly make full returns to their owners until the land's hunger for lime has been met. The only question is regarding the best way of meeting it."

Chapter II deals with the natural supply of lime in soils, stating that "the total area of lime-deficient soil is large, comprising certainly much more than half of all the land east of the semi-arid belt of the United States." Many soils that are rich in all other essentials are deficient in lime. The author concludes: "The day of destructive soil acidity can be retarded by good farming, but in the long run the inevitable losses of lime from most soils must be met by applications."

Conditions which make even limestone soils acid or sour are discussed in Chapter III. Due to these conditions, the author states, calcareous soils have been losing their distinctive feature, and immense areas of land naturally low in lime, have remained hampered in ability to make full returns for labor, fertilizer and seed." Leaching, the chemical combination of lime with other minerals in the soil and decaying vegetation and the removal of lime in crops are given as the causes of lime deficiency in all soils, sooner or later.

Chapter IV deals with evidences of acidity in the character of the vegetation. The following chapter deals with the common methods of ascertaining soil acidity, the Truog test being recommended as the best.

Sources of lime are dealt with in Chapter VI. This chapter deals largely with the difficulties created by conflicting claims for various forms of lime and the disagreement of scientists due to conclusions from tests of very limited scope. In the following chapter the author defines the terms used to designate the various forms of lime and limestone, explaining at the same time what their chemical names mean.

Chapter VIII deals with ground limestone, in which the author states: "We know that lime carbonate does the needed work in the soil so far as correction of acidity is concerned, but in the form of blocks of limestone it has no particular value to the land. Burning and slaking afforded to man a natural means of putting it into form for distribution, and it is only within recent years that pulverization of limestone for land has become a business of considerable magnitude." He then winds up his chapter with a strong recommendation in favor of "low-priced pulverizers" for farm operation.

The use of limestone, detailed in the following chapter, is in favor of liberal applications of rather coarsely-ground stone, using the common argument that the fine ground stone leaches out, while the coarse material provides a store for future use.

The use of fresh burned lime, described in the next chapter, "not only serves as an effective method for correcting soil acidity, but it improves the physical condition of tough and intractable clays, rendering them more friable and easy of tillage * * * and also renders organic matter in the soil more quickly available, an increase in yield quickly following an application. These three effects of burned lime brought it into favor, and a rational use would have continued it in favor." The author then explains that the irrational use of burned lime as a soil stimulant, rather than a soil corrective, has caused it to be feared by many farmers. The author states that "caustic lime hastens the decay of vegetable matter in a degree impossible to the limestone or marl," but concludes that "it is only the excessive use of caustic lime" that causes loss.

This leads him to describe burning lime on the farm as a desirable means of obtaining the material. The next subject discussed is lime hydrate, explaining what it is and accusing lime manufacturers of making claims for it as a fertilizer which are unjustified. On the whole the author does not seem to place hydrate in very high favor. Air-slaked lime, marl, oyster shells and wood ashes are all commended as desirable liming materials.

Magnesium lime he considers just as good as any other, provided there is any advantage in price, "except in the case of distinctly sandy soils." Chapter XV deals with the economics of lime buying, giving the equivalent weights of the various forms for the same neutralizing power. The importance of using a form of lime that can be easily and adequately distributed is emphasized. His conclusion is that "when everything is taken into account, one is justified in using limestone or air-slaked lime at a cost per ton three-fourths as great as that of lump lime"—these figures applying to the cost delivered on the farm.

The remaining three chapters deal more with the lime after it reaches the farm and include descriptions of lime spreaders, amount of lime to use per acre, and special crop demands. For really acid soils, the author recommends the use of two tons of fine-ground stone, or 1¼ tons of fresh burned lime per acre, with a smaller application at the end of three or four weeks. "In the case of a normal soil that has ceased to grow clover, and does grow plants that are acid-resistant," the author states, "it is better practice to secure a relatively low-priced supply of coarsely pulverized stone and apply three or four tons per acre, and lengthen the interval between applications to 8 or 10 years."

As will be seen from the above quotations, the book justifies the use of all forms of lime and leaves a pretty clear distinction between what each form can accomplish. Lime and limestone producers will disagree with much of the argument in favor of the farmer producing his own lime, but with the average reader the impression left by the book, as a whole, is that the urgency of using lime in some form is so great that any means of obtaining it are justified—certainly a very desirable impression to create from the standpoint of the lime industry.

Lime as a Rust Preventive — Or Why Hydrate Should be Used in Plaster

Effects of Lime and Gypsum on the Corrosion of Iron and Steel

By Thomas W. Cappon
Consulting Chemist, Denver, Colorado

WHAT EFFECT, if any, has plaster of Paris on the iron or steel it is brought in contact with? Does it produce corrosion of the metal, or is that effect, sometimes noticed, due to other agencies?

This question is often asked by builders, and discussed by technical men, and variously answered.

It is only natural that those interested in the manufacture of gypsum products should take a favorable view of the question and answer it by a decided negative; though a few have lingering doubts, as in the case of the manufacturer who desired the writer to "look into" the matter for him, and devise some experiments that would throw some light upon it.

Moisture Essential but Not Cause

It is easy to imagine conditions where a mistake as to its influence in this respect might result in serious troubles from discoloration, due to rust stain seeping through the white walls of an expensive building and then, a not uncommon case, where the plasterer blames the maker for unsatisfactory material, and the latter blames the plasterer for using improper methods. That such results as the above can occur under certain conditions is admitted, but the blame is usually laid—in accordance with a theory generally held—not to the plaster, but to the moisture which gains access to the work and begins the attack.

Admitting the fact, it is permissible to deny the inference usually drawn from it; for this alone is really no proof that the plaster, after all, may not be at the root of the mischief; for by similar reasoning it might be possible to show that chlorine gas will not oxidize, or sulphurous acid bleach, which "is absurd" as Euclid puts it. For it is a fact well known to chemical science that these powerful reagents lose these characteristic properties when the gases are perfectly dry.

Furthermore, dry lime has no action on dry carbonic acid, this may seem startling to the lime man, but is nevertheless true. Neither has sulphurous acid or chlorine any action on quicklime, when those bodies are really and not apparently dry, though combination takes place energetically the moment moisture is admitted.

Shall we conclude then, because moisture is a necessary condition before such chemical action occurs, that the active agent in the case was the water?

Surely no. Water has no bleaching properties, whereas sulphurous acid and chlorine have such properties.

Theories of Corrosion

A full consideration of the subject raises the whole question of "Corrosion," about the nature of which there are several theories, and quite an extensive literature, but it will not here be necessary to go farther into it than to state, briefly, that according to one of these theories—the "Electrolytic"—the main cause of rusting is electrolysis, due to impurities in the metal, which cause a difference of electric potential, and thus produce local action, solution, and oxidation of the metal.

In the other theory of corrosion the cause is held to be carbonic acid—usually present in freshly formed rust—or acid of some kind, as it is asserted that pure iron will not rust even in water saturated with oxygen.

Not only do the various theories on the subject differ, but, what is rare in matters scientific, there is a difference as to the observed facts. At present the consensus of opinion seems to incline towards the electrolytic theory. If that view of the question be correct, one of the conclusions that may be drawn from it is, that plaster of Paris must necessarily produce corrosion of the iron or steel it is in contact with; for, with the advent of a little dampness there must be solution of the partly soluble gypsum, then partial dissociation of the gypsum into basic, and sulphuric acid "ions" with resulting electrolytic action and oxidation of the metal as the final stage—plaster being a compound of lime and sulphuric acid. (Pure water not being ionized will not conduct.)

Writer's Experiments

The above are some of the theoretical considerations that may be drawn from the facts of chemistry, but certain experimental results obtained by the writer may serve to place the matter in a clearer light.

In order to study the action of plaster on iron a number of tests were made by mixing a quantity of pretty pure gypsum plaster with a little water and from 10 to 15 per cent of powdered iron. The "mix" was then poured into shallow cylindrical molds of wood and pasteboard, and the surface troweled off flush with the edge so as to show the iron particles studding the plaster. No retarder or accelerator was used. The whole was allowed to set hard, which it did in a short time. In four or five days the metal particles in the plaster could be located by the brown spots of rust surrounding them, plainly showing corrosion.

With the view of determining the active agent in this result, another set of experiments were made using plaster and powdered iron as above, but with the further addition of from 10 to 15 per cent of lime putty, (hydrated lime). The mixture was tempered with water to about the consistency of wall plaster, and the molds filled with it as before.

This time, however, the plaster showed hardly any signs of rust, after the same lapse of time, notwithstanding the presence of moisture. The above tests were made quite a number of years ago.

Further Proof of Effect of Lime

One more experiment in conclusion. This test was made by a United States engineer, M. Meigs, C. E., and while not undertaken to show the action of plaster of Paris—which the operator in fact did not have before his mind, the object being to ascertain the value of lime as a rust preventive—it has, nevertheless, an indirect bearing on the subject of this article.

The experiment consisted in preparing two pieces of angle iron (structural) by sand blasting all the faces except one of each piece, and in addition polishing one face, then immersing in fresh Mississippi River water.

The Author

MR. CAPPON is already well-known to ROCK PRODUCTS readers from his previous contributions. He is one of the foremost experts in this country on plaster—both lime and gypsum.

The Mason jar containing one of the pieces had, in addition to the water, slaked lime to the depth of half an inch. The steel was left immersed in the water for 14 months. The steel immersed in the river water was found to be quickly corroded, not only covered with rust, but a considerable amount of the rust had flaked off and fallen to the bottom.

The steel immersed in the jar with lime was absolutely unaffected. Not only was there no rust after 14 months, but the polish on the polished face was as perfect as when the steel was first put in the water, from which he naturally concludes "that lime hydrate, far from corroding, forms an excellent and cheap preventive of rust" (Professional Memoirs, M. Meigs), quoted in "Concrete" 1916.

The practical application of the foregoing studies and experiments on gypsum plaster consists in this, that although plaster of Paris will under certain conditions produce corrosion, the remedy is both simple and easy. As some manufacturers use plaster of Paris "straight" in their wall plaster, when these conditions—iron and moisture—are likely to occur, it would be well to add a certain proportion of hydrated lime, in addition to the retarder sand, etc., of the formula. This will likely necessitate a change in the other proportions, as the powder of some of the other constituents will be affected by the change.

In the case of lime plasters no such complications are to be feared, although in other respects the caustic action of the lime would interfere with certain colors used in decorative work; otherwise lime plaster is not only non-rusting in itself, but a preventive of rusting in other materials.

Comment on Mr. Cappon's Article by Virgil G. Marani, Chief Engineer, Gypsum Industries Association

IN ORDER to have a complete presentation of the subject in one issue, proof of Mr. Cappon's article was submitted to Virgil G. Marani, chief engineer of the Gypsum Industries Association, for his comment. Mr. Marani writes as follows:

"Sir: Thomas W. Cappon's article is of interest since it resurrects questions that have been satisfactorily disposed of some years ago, after investigations and tests conducted for some of the leading plaster manufacturers.

"When considering the effects of materials applied in a plastic state to iron or steel it is important to clearly differentiate between *initial* and *progressive* corrosion, since the former is harmless to the construction involved, while the latter, because of its destructive and injurious character, has occupied engineering minds ever since the introduction of reinforced concrete.

"It should also be understood that corrosion, whether initial or progressive, is encouraged by the presence of impurities in steel, such as sulphur, manganese and silicon. Pure iron is not quite so susceptible to corrosion of any character, but again, most of the metal used in building construction for structural supports, reinforcement, or as a base for plaster consists of steel.

"The initial corrosion of steel or iron, not galvanized or covered with protective pigments, has always been conceded and is to be expected in all constructions involving such unprotected metals as are embedded in any material which has to be brought to a plastic state with an amount of water in excess of the quantity needed for thorough mixing, but which is necessary in order to provide economic and practical working conditions and satisfactory results.

New York Experience With Gypsum Floor Slabs

"No better illustration of the permanency of metal (steel and iron) embedded in gypsum, can be found than in existing fireproof roof and floor constructions of gypsum throughout the country formerly known as the 'Metropolitan System.'

"During 1911 the question of progressive corrosion was taken up by the New York City Joint Committee on City Departments. A sub-committee conducting a special investigation of this question, as effecting gypsum, caused the uncovering of the reinforcing steel used in the construction of the Metropolitan (gypsum floor) which formed the roof garden of Hammerstein's Victoria Theater.

"S. G. Webb, the then Secretary of the Gypsum Industries Association, was present during these investigations and in a sworn affidavit in Bronx County, No. 4, Bronx Register No. 606, dated February 7, 1916, attests to the condition of the embedded reinforcing material. For the benefit of readers the affidavit is quoted in full as follows:

Samuel G. Webb, being duly sworn, deposes and says that on the twenty-eighth day of January, 1916, he forwarded by mail to Mr. Virgil G. Marani, 205 West Monroe St., Chicago, Ill., two samples of reinforcement material taken from the Metropolitan floor slab which formed the roof of Hammerstein's Victoria Theatre and the floor of the Roof Garden above the Theatre, when the building was torn down during the summer months of 1915.

The said Samuel G. Webb further deposes and says that he took the pieces personally from the embedded floor slabs which were in the process of being torn down; that the twisted wire formed part of the twisted wire cables which were embedded in the floor slabs and completely surrounded with the gypsum material; that the bent round rod is what is known as an S hook, holding the ends of the wire to the structural steel at the end panel, and was also completely embedded in the gypsum material; that to the best of his knowledge and belief the floor slabs with the metal embedded in them had been in place for a period of about fifteen years; that the Hammerstein's Victoria Theatre was located at the corner of Seventh Avenue and Forty-second Street, New York City; that the S hook was not galvanized or coated with any preservative coating, but that the twisted wire forming the cables was galvanized.

Samuel G. Webb further deposes and says that he made an examination of the embedded, twisted wire cables and the embedded I beams supporting the floor, in the presence of the Sub-Committee on "Engineering Subjects" of the Joint Committee of the City Departments of New York City, in the year 1911, during the time that the Joint Committee on City Departments was investigating the subject of corrosion. This examination was made by cutting into the floor slab at a location under the stage and near a tank of water which was used for diving and other purposes during performances, and that the examination showed that the embedded steel, both the twisted wire cables and the I beams, showed only initial rusting, and that the rusting had not progressed and that as a result of this examination the said Sub-Committee on "Engineering Subjects" was favorably impressed with the condition of the steel.

"In the above quoted affidavit reference is made to *"only initial rusting,"* which occurs in all such constructions, including reinforced concrete and which is expected. Also, the Sub-Committee on "Engineering Subjects" noted that the *"rusting had not progressed,"* and *"was favorably impressed with the condition of the steel."* As a result of this conclusive evidence covering a period of more than 15 years, the building codes of New York, the National Board of Fire Underwriters, and others include the use of gypsum for the fireproofing of steel columns, trusses, girders and beams. The gypsum used for fireproof floor and roof constructions, is basically the same as the gypsum used for plasters, tile, and other products used in building construction.

Under date of January 26, 1916, Dr. W. F. Hillebrand of the U. S. Bureau of Standards states the following:

It is incorrect to speak of a "sulphuric acid content of gypsum." The properties of sulphuric acid are lost when the acid is fully neutralized, as in gypsum.

In corroboration of the above, it is perfectly simple for any one to conduct the usual litmus paper acid test on gypsum by mixing gypsum with water and dipping blue litmus paper in the mixture. There will be found no acid reaction, in other words, the blue litmus paper will not change color.

Tests have shown that initial corrosion occurs on unprotected steel and iron, due to the presence of water in the plastic mixture. When this mixture (concrete or plaster) is dry there can be no further (progressive) corrosion. Under normal conditions gypsum plaster coats will sufficiently dry out, so as not to contribute to progressive corrosion, in from 48 to 56 hours. The initial corrosion during this period has been found to approximate 6/10 of one per cent loss in weight of the metal, an item so slight as to be negligible. That

corrosion does not progress after the construction has dried out is self-evident, for if the rate of initial corrosion continued many unprotected metal lath and plaster constructions rendering good service today would have indicated failure at a comparatively early stage.

J. C. Pearson of the U. S. Bureau of Standards, in a progress report on "Some Comparative Corrosion Tests of Plastered Metal Lath," in which protected and unprotected metal lath was used, and in which lime and gypsum plasters were applied, states the following:

> Examination of the table will show that the condition of the lath under the three representative brands of gypsum plasters is almost exactly a general average condition of all the interior panels—(viz., lime or gypsum plasters on metal lath).

It is not possible, within the scope of this article, to furnish a complete list of old constructions involving the use of metal lath and gypsum plaster. The following buildings, equipped in this manner, are approximately 17 years old:

> Dwight Bldg., Jackson, Mich.; Germania Bldg., Milwaukee, Wis.; Independent Telephone & Telegraph Co. Bldg., Streator, Ill.; St. Francis Xavier Academy, Ottawa, Ill.; Y. M. C. A. Bldg., Indianapolis, Ind.; Pierce and Coliseum Bldgs., St. Louis, Mo.; Bronx Safe Deposit Co., New York; Buel and McDonald Bldgs., Schenectady, N. Y.; Medina Temple, Chicago, Ill.; Cass County Court House, Fargo, N. D.

In monumental and other high grade buildings all heavy interior cornices, moldings, domes and false or suspended ceilings are constructed of metal lath and gypsum plaster. The fire-resistance, quick setting, as well as the high tensile and compressive value of gypsum plaster makes the use of this material in combination with metal lath not only necessary, but advisable. The annual use of about two million tons of gypsum plaster in the United States is mute evidence of this fact.

Concluding the question of progressive corrosion, the following, based upon the evidence of existing data, seems to be correct: That when gypsum is used upon *unprotected* metal lath, or in contact with structural metal for the purpose of fire protection, and when wet air and moisture are prevented from coming in contact with such *unprotected* metal, no progressive corrosion can occur. Gypsum in the manner outlined is used for interior and protected constructions only. Where wet air or moisture is anticipated, galvanizing or similar protection should be given the metal. The best specifications call for protected metal.

Upon the question of the "electrolytic theory" the investigations of the U. S. Bureau of Standards, and the Portland Cement Association, conducted by Messrs. R. J. Wig and Lewis R. Ferguson, respectively, contain the following:

> The cracking of the concrete in sea water always starts *above the high water line*, although it may extend a little below this point as corrosion develops. Very seldom is it found to go down as far as the elevation of low water, and then only when the reinforcing is deeply embedded, so that the spalling effect extends a considerable distance below where the metal is affected.
>
> This condition was also noted in the report of the British Institution, and it effectually disposes of the electrolythic theory. In all the experiments made to determine the action of electric current on reinforced concrete, it has been found that cracking due to the corrosion of the steel reinforcing starts where the current leaves the rods. Therefore, if electrolysis were the cause of the corrosion, then cracking must occur below the elevation of high water, where the current leaves the metal. In a reinforced concrete marine structure in which the corrosion and deterioration do not extend below the water line, electrolysis cannot possibly be the cause. For this reason, also, the corrosion of the reinforcing referred to in the report of the British Institution cannot be caused by electrolysis, for it is stated that the cracking of the concrete occurs above the level of high water.

The foregoing remarks are not intended to contradict Mr. Cappon's conclusions that the use of a small percentage of hydrated lime in concrete mixtures assists in the prevention of corrosion. This fact has been known to the engineering profession for some years and many reinforced consion for the use of lime in this manner in crete specifications of today make proviconstructions where the concrete is likely to be subjected to conditions favoring possible attacks from moisture, or as a purely precautionary measure.

The addition of lime, in any form, to gypsum plaster, or in constructions of gypsum, is not necessary as a corrosion preventative. At the present time practically all gypsum constructions are confined to interior or protected dry locations where progressive corrosion is impossible. In cases where gypsum might be used for outside or exposed constructions, and would be subject to alternate wetting and drying, the exposed work must be suitably waterproofed or should be covered with weather protective coverings.

GYPSUM INDUSTRIES ASSOCIATION,

VIRGIL G. MARANI,
Chief Engineer.

Potash from Greensand Marl

Interesting History of the New Jersey Greensand Deposits Now About to be Commercialized

By John H. Voorhees
New York State College of Agriculture, Cornell University, Ithaca, N. Y.

THE NOTICE in Rock Products of the development of a manufacturing plant to recover potash from greensand marl at New Brunswick, N. J., is an interesting outcome of wartime activity. During the first two years of the war, while it was impossible to secure German potash salts at reasonable prices, there were many debates among farmers regarding the value of potash. Soils had been well fed for many years and there was a temporary excess of potash in these soils. Today, however, this excess has been used up by severe cropping and farmers generally await with anxiety the return of potash salts at reasonable prices.

Greensand marl, as it is, without treatment, has played a very wholesome part in the development of New Jersey agriculture. Years ago, when labor was cheap, greensand marl was used quite generally. The analyses showed that different deposits varied widely in composition. The average analysis showed about two per cent of phosphoric acid, four to five, and sometimes as high as eight, per cent of potash, and two to three per cent of lime. These constituents, especially the potash, were only slowly available.

Marl, however, is an important amendment to soils, not only because of its content of mineral constituents, but because these constituents are associated with products that exert a very favorable mechanical effect upon soils. Large areas of land in New Jersey, formerly unproductive, chiefly because of physical imperfections, have been made very productive, mainly through the use of marl.

The value of marl, however, only becomes apparent through the years, and as commercial fertilizers and the soluble salts of potash became more common the use of marl decreased, until at the opening of the war, few except the older men on the farms were familiar with it. But it was not long before those having pits began to open them, not alone for their own use, but also for sale to neighbors. The use of the material became quite extensive. It was readily observed, however, that the results from marling were due quite as much to the improvement of the physical condition of the soil as to the fertility constituents added.

It was the practice among farmers to cart and spread marl upon the land when other work of the farm was not pressing, thus making it possible to get a considerable addition of fertility at a small expense. Today it is very difficult to secure labor at prices very high for farmers to pay, and as soon as potash salts are put on the market at fair prices the farmers will welcome it. Marl will be left to the legitimate producer for mining and recovery, and the farmers will eagerly purchase the soluble potash products of manufacture.

This company should have a wholesome effect also upon the agriculture of the country immediately surrounding New Brunswick, because practically all soils in the neighborhood are sour.

How Industrial Democracy Has Worked

Examples to Show Even Partial Adoption of Leitch Plan Solves Many Problems

By B. C. Forbes

THE EYES OF THE EMPLOYERS, and even the public, are being opened by the ertraordinary results that can and are achieved when a company extends to its workers a reasonable measure of Industrial Democracy and treats with them in man-to-man fashion, on a friendly co-operative basis.

Take this incident: The Passaic Metal Works are run under the Leitch system of Industrial Democracy. Recently there were persistent reports afloat there that plans were being engineered to call a universal strike to enforce the introduction of a forty-four hour week. President I. W. England, of the Passaic Metal Ware Company, after referring to these reports, states:

"Our machinists voluntarily and without suggestion from anyone have met and gone on record publicly, and, furthermore, pledged themselves, to refrain from joining any such movement and to stick on the job with thorough satisfaction under the existing conditions, for, as they have expressed it, they know that if the forty-four hour schedule becomes general and on a basis which does not place our organization at a disadvantage, they will obtain the same advantage under Industrial Democracy, without strike or friction of any kind, as a simple matter of justice."

At another plant operating under the Leitch Industrial Democracy plan, the House of Representatives—consisting solely of the rank and file of employees—recently issued a statement, at a time when a strike was on at other plants in their line, that the employees of this company were entirely satisfied with their working conditions and affirmed their intention of remaining absolutely loyal to their employers, since there had never been the slightest disposition to deny them anything within reason.

Establishes Cordial Understanding

These are but typical illustrations of how Industrial Democracy brings about an attitude of ardent loyalty and enthusiasm among workers operating under it. It succeeds in establishing the most cordial understanding between management and men. Indeed, democracy in industry has worked much more smoothly than democracy is operating today at Washington. At the Capitol there is almost constant wrangling in both Senate and House and frequent clashes between these two bodies. Under Industrial Democracy there is, of course, plenty of healthy discussion and debate, but rarely any fiery friction between the Senate, consisting of foremen, superintendents, etc., and the House of Representatives, composed of the ordinary workers.

In order to facilitate the successful installation of Industrial Democracy in plants throughout the country, Mr. Leitch has arranged to give a course of training to responsible representatives from different companies, and the demand for this instruction is overwhelming. One of the very largest manufacturing companies in the United States is the latest convert to Industrial Democracy, and other enterprises of great magnitude are now actively negotiating with a view to introducing the plan as soon as proper arrangements for installing it can be made.

The newspapers lately have recorded eye-opening incidents illustrative of the wonderful change effected upon the minds of workers when granted a voice in the conduct of their plants. The Midvale Steel Ordnance Company has a system for co-operating with its men, and the newspapers not long ago gave great prominence to a resolution adopted by the Midvale workers, declaring that, "The persistent and unceasing demand of workmen employed in all classes and kinds of industries for a shorter day's work and an increased wage in order to meet the present high cost of living is uneconomic and unwise and should not be encouraged."

Baker Advocates Co-operation

Can you imagine any set of workers operating under Industrial Autocracy voluntarily coming forward with such a declaration? Yet this is only a typical instance of the attitude produced wherever workers are given a voice in management and otherwise treated in straightforward, democratic fashion.

Although much confusion was created concerning what has developed at the Rock Island Arsenal—through the unjustified efforts of advocates of the "Plumb Plan" to create the impression that the principles advocated by railway workers had been adopted there—nevertheless what has actually happened at the arsenal is extremely illuminating. It affords additional testimony of the transformation produced among workers when permitted to have a voice in the running of their plant and taken into the confidence of the management in a co-operative way. The Rock Island Arsenal was not turned over to the workers, as claimed by "Plumb Plan" enthusiasts; what was done is described by Secretary of War Baker in these words:

"The War Department has encouraged the formation of committees of its employees in the arsenals, which committees consult freely with the men and act in an advisory capacity to the management on questions of shop conditions, production and wages. By this means hearty co-operation has been secured, and complete sympathy between the management and the employees has resulted.

"The authority of the management, however, is wholly undiminished by the advisory relation of the committee—the management of the plant is undisturbed—the Government operates them, and the authority of the commanding officer is as complete as it has always been.

"The whole purpose of the steps which have been taken is to bring about understanding and good feeling, but not in any sense to part with either the responsibility or the authority of the Government in the management of these industrial enterprises."

Now, although apparently the arsenal employees were not granted quite as much, say, in the running of things, as is extended to workers under the Leitch system of Industrial Democracy, yet even this modest measure of co-operation had remarkable effect upon the men, as will be gathered from the following letter addressed to Secretary Baker by the employees' representatives:

"Primarily the employees feel that yourself and General C. C. Williams are interesting yourselves in them in a vital significant way, that is, concerning the stability of their positions, rather than in paternalistic ways such as have been tried with questionable results in so many instances during the past. They realize that their status is now in the process of change. They no longer feel like mere employees, simply bent on holding down a job quite apart from their conception of life, for no other purpose than the earning of wages, the only crude means available to them for securing the necessaries and perhaps a

little of the better things of life. They are beginning to see that they are on their way toward becoming partners in a large enterprise.

"It has been very gratifying to us to note, many times, that the necessity on the part of the men for economical production is well understood. For instance, at Watervliet Arsenal recently during the noonday rallies which are being held, the appeals of the speakers, who were from the workers, were for efficiency. At Watertown some of the men stated that in the interest of the workers their abilities were limited when it came to functioning on employees' committees, handling grievances, etc., for, they said that that was not their forte. They did not feel able to confront the management in sufficiently forceful ways while prosecuting cases of such a nature.

"But, they said, they clearly saw their opportunity in the chances which now existed for functioning on production committees. Their abilities, they felt, lay in that direction and they most enthusiastically welcome the circumstances which promise them these new opportunities for self expression. At Frankford and Rock Island instances have occurred where the employees have 'gotten after' individuals who have not been doing as well as they might.

Instance of Splendid Thrift

"A striking instance of the splendid spirit of co-operation which automatically develops when the employees are given an incentive and a chance for self-expression recently occurred at the Frankford Arsenal. The Post Office Department was in the market for a large order of dials for registered mail locks, for which they had previously paid $45 per thousand. Frankford Arsenal submitted an estimate of $38 per thousand; so when the committee on estimates informed the employees they had figured very closely in order that this work could be secured for them, the employees were enabled to demonstrate their appreciation of this new condition and volunteered to work during lunch hour, if necessary, to live up to their committee's judgment as to direct labor costs.

"There is attached hereto a statement concerning the way things work when the employees are enabled to participate in the management of the shop. This is but a mere indication of what really can be made possible in a large way throughout all the arsenals. In short, a spontaneous efficiency is in the making, which, we sincerely feel, will before long produce records of production that will make the most ardent Taylor system advocate envious. And this will all be because the employees want to produce, not because they are obliged to do so.

"We find as a whole that the attitude of the local management is conducive toward the development of this new spirit. Where misunderstandings have existed or still exist we hope to help straighten them out by education and the demonstration of our unalloyed sincerity and loyalty to all the interests at stake.

"We are, and will be for a long time, suffering from the heritages of the conditions we are now on the way toward eliminating. It is our conviction, more now than ever before, that before long the opportunity will be ripe for us to secure outside talent in the form of competent management engineers and production experts to advise us as workers what we can do to help improve things, what the management can do and, finally, what we and the management can do jointly.

"We are not unaware of our own limitations in this respect, and, when the time comes, we hope sincerely that you and the Chief of Ordnance will gladly extend to us the opportunity to have our technical experts co-operate with the arsenal management and their experts for the purpose of doing everything possible to warrant the fullest utilization of the arsenal as centers of production."

To this letter Secretary Baker replied:

"The Government needs not only the hands of its employees, but their heads and hearts, and the spirit of co-operation and loyal enthusiasm illustrated by the instances which you cite to me are not only evidence of a present sound situation but promising of constant future improvement."

It is significant of the general trend toward bringing about closer co-operation between executives and workmen that the Senate's bill for restoring the country's railroads to their owners provides that all questions regarding wages be brought before a committee consisting of four representatives of the company and four representatives of the employees. It is noteworthy, too, that the proposed measure—it is called the Cummins Bill, because evolved by the subcommittee of the Interstate Commerce Committee of which Senator Cummins, of Iowa, is chairman—also stipulates that two employees' representatives be given seats on each board of directors.

There is, moreover, another provision in the bill not unlike another feature of Industrial Democracy; under Industrial Democracy wage dividends are paid based upon savings effected by each department, and the Cummins Bill contains the provision that after payment of "a fair return upon the value" of the railroad property, one-half of any excess profits be applied, first, to improving the conditions of work of the railroad men, and after that, that there be a direct share by the men in the excess returns (the other half of the excess profits to be placed in a fund for the use of the railroad board in purchasing equipment or lending it to individual roads for that purpose).

I believe that there is no more important problem confronting America today than the establishment of amicable, mutually profitable relations between so-called capital and labor, and my conviction is that the solution must be sought along lines tending to bring about a greater measure of democracy in industry.—(Copyright Forbes Pub. Co.)

Form of Advance Payment for Aggregates Approved by Contractors

"SEVERAL STATE HIGHWAY DEPARTMENTS are adopting the plan of paying for materials shipped in this winter for use next season, in order to facilitate road building as much as possible," says the December 6 "News-Letter" of the Associated General Contractors of America.

"In the 'News-Letter' for November 29, a statement was published as to the objectionable features of the particular method of paying for aggregates adopted in Illinois, where it has been announced that payment will be made direct to the producer or manufacturer. Information already received from three other states, namely, Iowa, Minnesota and Maryland, indicates that the provisions made in those states are desirable in that monthly estimates are paid on materials delivered as well as on materials in place. This leaves the contractor in control of the delivery of aggregates, and one might add, of his business, and is certainly the fair way to handle the situation.

"With reference to the Iowa plan, F. R. White, Chief Engineer of the State Highway Commission, writes as follows:

" 'We have inserted the following clause in our specifications with reference to payment of estimates on materials delivered:

If at the time of any monthly estimate the contractor has delivered at the site or at the shipping points being used, unused materials, such as sand, stone, gravel, brick, cement, steel, asphalt, in an amount greater than can reasonably be incorporated into the work during the succeeding month, or at the rate of progress herein specified, and if in the judgment of the engineer such materials have been stored in such a manner as to properly protect the same from damage until they are actually incorporated into the work, estimates on such material will be allowed, based on the actual cost thereof, including freight and haulage charges.

" 'We hope to let contracts for a considerable amount of work this winter and it is our desire that contractors immediately begin the delivering of material. Through the payment of estimates on these materials, we will relieve the contractors of the possibility of tying up any considerable sums of money.' "

Brownell McGrew Joins Allis-Chalmers Sales Organization

BROWNELL McGREW, whose articles in ROCK PRODUCTS on the design of crushing plants have attracted wide attention and much favorable comment, has joined the sales force of the Allis-Chalmers Manufacturing Co., Milwaukee, Wis. Mr. McGrew was with the Allis-Chalmers organization for several years in its erecting department.

His experience has covered the operation of plants as well as construction, so that

Brownell McGrew

he is peculiarly well equipped to advise on plant remodeling and improvements, as well as new layouts. His many acquaintances and friends in the industry will wish him the best of success in his new connection.

Need of Business Organization

DEVELOPMENTS during the first week of the Industrial Conference show clearly the great need for organization of management in industry. It brings to mind the fable of the father who likened his sons unto a bundle of sticks—singly they could be easily broken, while collectively they would present a formidable strength.

No man can successfully conduct a business today along individual lines. His methods must conform to practices prevailing throughout his particular class of industry; his policies must be formed with due regard for what his competitors are doing or might do under given conditions. Usually it is not difficult for a business man to find principles that would solve his problems; but the value of a principle is in proportion to its application, and regardless of its worth, no principle can be successfully applied in industry today without intelligent co-operation of all concerned. Give your association your active support; it promotes harmony and brings prosperity throughout the industry.—The Chicago Sand and Gravel Producers Association News Letter.

Montana Seeks Lower Rail Rates on Sand and Gravel

HELENA, Mont.—The Montana Railroad Commission is seeking lower rates from the United States Railroad Administration on sand, gravel and crushed rock, which are being used in the construction of highways, it is reported.

The rates the commission is endeavoring to obtain will permit free movement of these materials from all sources of supply to all destinations within a radius of 150 miles, regardless of whether the movement involves a one, two or three-line haul.

Limestone Not Included in Minerals

IN A SALE and conveyance of minerals the language of the deed making the grant may show that the parties only intended such minerals as were secured by the ordinary process of mining, and such a conveyance may not include limestone as mineral.—J. W. Thompson, "Abstracts of Current Mining Decisions," U. S. Bureau of Mines.

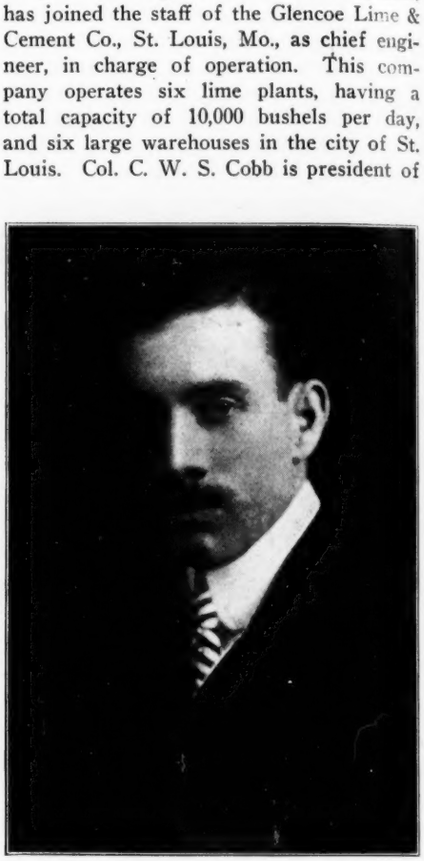
Utah's Great Potash Bed

SALT LAKE CITY—One practically untouched potash bed extending from Kosmo, Utah, over into Wyoming near Green River contains sufficient of these salts to supply the United States for 800 years, declares H. W. Prickett, who is now in Washington striving for a reduction of carload rates on this product to eastern and southern points. Assurances have been received from governmental officials that satisfactory rates to market will be granted, probably in October.

Small potash plants are now operating at three different points in the Utah-Wyoming field. Two potash mills are now operating on alunite ores in the Marysvale district in central Utah where commercial deposits are also extensive. Utah promises to become an important producer of this vital fertilizer within the next few years provided satisfactory railroad rates may be secured. It is reported that the Marysvale mills are now manufacturing and shipping daily more than 200 tons of potash products.—Wall Street Journal.

Harvey S. Owen Appointed Chief Engineer of the Glencoe Company

HARVEY S. OWEN, recently field engineer of the National Lime Association, with headquarters at St. Louis, Mo., has joined the staff of the Glencoe Lime & Cement Co., St. Louis, Mo., as chief engineer, in charge of operation. This company operates six lime plants, having a total capacity of 10,000 bushels per day, and six large warehouses in the city of St. Louis. Col. C. W. S. Cobb is president of



Harvey S. Owen

the company and E. S. Healey is secretary and treasurer

Mr Owen is a native of St Louis and a graduate of Missouri University (School of Mines, at Rolla), where he specialized in mining, geology, metallurgy and chemistry. He was State Chemist from 1910 to 1911. From 1911 to 1917 he was with the engineering department of the city of St. Louis. The Portland Cement Association acquired his services in 1917 as a promotion engineer, and he served the Lime Association in the same capacity from January 1, 1919, until recently. As engineer of the Lime Association Mr. Owen had charge of promotion in the district around St. Louis.

Mr. Owen is a member of several engineering and scientific societies, including the American Society of Civil Engineers. His connection with the operating end of the lime industry is a step which will be welcomed by all who look forward to placing that industry on a broader and firmer engineering and scientific basis.

Eastern Building Material Market Still Soaring

Reports Indicate That High Peak-Prices Will Not Be Reached Until Latter Part of Next Summer

COMMENT on the building situation is made most eloquent by the mere recital of building material price movements at the close of a remarkable week, says the Dow Service Daily Building Report.

Hollow brick advanced $1.25 a thousand, expanded metal lath moved up a cent a foot, wood lath advanced from $11 a thousand, delivered, to $13; and finishing and common lime advanced 30 cents a barrel. At the same time there was marked stiffening of price quotations and delivery conditions on common brick, plaster, asphaltum, sand, gravel and crushed stone.

Portland cement is the only commodity that gave no positive outward evidence of an impending price change upward, but the best advice obtainable from mill centers supplying this market is that after the first of the year there will be a higher price quoted for this building commodity.

Purchasing for Next Year's Business

Intimations coming to this market from sources of building material supply reveal the extent of the forward purchasing that has been done within the last few weeks in anticipation of the early start of the 1920 building movement. Comparing stocks on hand of building paper, for instance, as of October 31, with the average daily production based upon weekly and monthly reports filed during a period of 18 months prior to September 30, 1919, there is a reserve available barely equal to seven days' average output.

Cold weather within the last week has brought the close of navigation in the Hudson to almost a point of actuality.

In many departments of the building material industry the coal shortage is becoming a serious menace. In the roofing slate department there is very little mottled slate being produced. There will probably be another important increase in the price of this kind of roofing material around the first of the year. The trade is looking for better quarrying conditions next year with more stable, though higher, prices. The advice is being passed along to dealers to load up on as much slate as possible before the turn of the year.

High Peak-Price Far Off

It is becoming evident that the high peak-price of building materials in general cannot now be expected until the latter part of next summer, and quite possibly not until the autumn of 1920 has set in. If there is any one who doubts this probability let him compare the latest available building movement with that of recent years.

From compilations gathered last month by the Commercial and Financial Chronicle, it appears that the curve line in the chart of building recovery is steeper in an upward direction than has been known in many a decade. From the extreme low levels of last year, caused by various retardant influences, the curve line from 175 cities reporting for October showed a gain in building activity of 131½ million dollars for October over the same month in 1918, and over 70 millions over the large aggregate of 1916.

The aggregates for the whole country for the ten months of the last four years are 1,050 millions for 1919, 405 millions for 1918, 660 millions for 1917 and 870 millions for 1916. For greater New York the totals are 194 millions for 1919, as against 54 millions for 1918, and is only 8 millions below the high-water mark for this city in 1916.

For New York City the October building activity is measured by a contemplated expenditure of 24 million for this year against only 4 million in 1918 and 14 million in 1916.

In companionship with these statistics it is interesting to note that building material production is restricted by lack of common labor and difficulty of obtaining raw materials, containers, etc., to barely 40 per cent of capacity, while the embryonic building demand is already far beyond the totals of the biggest building year the country ever had. The supply of building materials is lower than it has been at any time since the Civil War.

Census Preparations for Rock Product Industries

WASHINGTON, D. C.—Classification of the rock products industry, for purposes of the 1919 census of manufactures, has just been completed by the Census Bureau of the Department of Commerce. More than 350 classifications have been worked out for this purpose; the general rule has been to determine the classification in accordance with the product of chief value with the idea of bringing together, so far as practicable, all the establishments engaged in the same or kindred industries.

A general schedule has been provided for the use of all industries, but in a number of branches of the rock products industry this schedule does not afford sufficient facilities for registering all the data required and, in such cases, an additional or supplemental schedule has been provided.

Thus, while manufacturers of marble and stone work will use the general schedule, No. 100, producers of sand-lime brick will be required to fill out not only that schedule, but supplemental schedule No. 183 as well. Marble and stone work has been classified to include monuments, tombstones, etc., and other manufactures of stone and marble except millstones, roofing slate, slate blackboards, soapstone work, and all kinds of builders' and plumbers' marble and stone material. The census of sand-lime brick plants is to be taken in co-operation with the Geological Survey. Manufacturers of lime will use supplemental schedule No. 180, and manufacturers of cement will use supplemental schedule No. 171.

The general schedule will be used by manufacturers of artificial stone products, which includes articles manufactured from a combination of stone, gravel, sand, or metal, with cement. These products include building blocks and trimmings, etc., but not blocks or tile for paving or roofing.

The preparation and printing of the various schedules has been completed and the work of sending them out to manufacturers will begin within a few days.

Building Trades Employers and Employes Sign Two-Year Wage Agreement

A RECENT agreement between the Building Trades Employers' Association and the Building Trades Council in the city of New York has provided for two years' uninterrupted building construction.

The agreement provides for a fixed scale of wages from Jan. 1, 1920 to Dec. 31, 1921, and establishes a 44-hour week, making it binding for all the unions involved to supply men for the Building Trades Employers' Association members.

The agreement will affect 150,000 building trade workers, or 33 different classes of mechanics. Suitable provisions have been made for future readjustment of the wage scale, should living conditions change sufficient to warrant, and a permanent board of arbitration has been established. The wage scale varies from $4.50 to $9.25 per 8-hour day, in the different trades.

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F. O. B., at producing plant or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Auburn and Syracuse, N. Y.	.80	1.20	1.20	1.20	1.20	1.20
Burlington, Vt.	.75@1.00	2.50	2.50	2.00	2.00	.....
Chaumont, N. Y.	.....	1.75	1.65	1.35	1.25	1.25
Coldwater, N. Y.			Flux, 1.50@2.10			
Limekiln, Md.	1.25	2.10	2.00	1.75	1.40	1.25
North Leroy and Akron, N. Y.	1.00	1.00	1.00	1.00	1.00	1.00‖
Pittsburgh, Pa.	1.25	1.40	1.50	1.50	1.50	1.50
Redington, Pa.	1.00	1.10	1.10	1.10	1.10	1.10‖
Walford, Pa.	1.50	1.60	1.60	1.60	1.60	1.60
CENTRAL:						
Alden, Ia.	.50	1.00	1.00	1.00	1.00	.....
Alton, Ill.	1.75@2.00	1.30	1.30	1.30	1.30	1.30
Bettendorf, Ia.			1.50 per cu. yd., all sizes			
Brillion and Sherwood, Wis.	.90@1.00	.....	1.00	1.00	.....	1.00
Buffalo, Ia.	.90	1.30	1.20	1.10	1.10	.....
Chicago, Ill.	1.00@1.20	1.20@1.50	1.00@1.20	1.00@1.20	1.00@1.20	1.00@1.20
Davenport, Ia.	1.50*	1.50*	1.50*	1.50*	.....	.....
Dundas, Ont.	.65	1.20	1.20	1.20	1.00	1.00
Eden and Knowles, Wis.	1.00	1.00	1.00	1.00	1.00	.....
Elmhurst, Ill.	1.00@1.25	1.00@1.25	1.00@1.25	1.00@1.25	1.00@1.25	1.00@1.25
Greencastle, Ind.	1.00@1.50	1.25	1.10	1.00	1.00	1.00
Hull, Canada	2.50	2.75	2.75	2.25	2.00	1.75
Illinois, Southern	2.00	1.35	1.35	1.35	1.25	.....
Krause, or Columbia, Ill.	1.30@1.80	1.10@1.40	1.10@1.50	1.10@1.40	1.00@1.20	1.00@1.20
Laumon, Wis.	1.25	1.25	1.25	1.25	1.25	1.25
Lima, Ohio	1.40	1.40	1.40	1.40	1.40	1.40
Mayville, Wis.	.80@1.00	1.00	1.00	1.00	1.00	1.00
Moline, Ill.			1.50—2300 lbs. all sizes			
Montrose, Ia.	1.25	1.15@1.25	1.15@1.25	1.10@1.25	1.10@1.15	.....
Oshkosh, Wis.			1.25 per ton, all sizes			
Ottawa, Ont.	2.50	2.75	.....	2.25	2.00	.....
River Rouge, Mich.	.....	1.25	1.25	1.25	1.25	1.25
Sheboygan, Wis.			1.00 to 1.25 all sizes			
St. Louis, Mo.	.60	1.60	.....	.....	.....	.....
Strolle, Ill.	.....	1.30	1.30	1.30	.....	.....
Stone City, Ia.	.50	.....	1.60	1.50	1.40	.....
Toronto, Canada	1.55	2.10	2.10	2.10	1.90	1.90
SOUTHERN:			These prices include 90c freight			
Brooksville, Fla.	1.00	.....	.....	2.60	.....	.....
Cartersville, Ga.	.....	1.95	.....	1.85	1.75	.....
El Paso, Tex.	1.00	1.00	1.00	1.00	1.00	1.00
Fort Springs, W. Va.	1.00	1.15	1.60	1.50	1.45	.....
Mascot, Tenn.	.....	1.00@1.25	.....	1.50	1.50	.....
Winnfield, La.	.80	2.00	2.00	2.00	1.80	.....
WESTERN:						
Atchison, Kans.	.50	1.80	1.80	1.80	1.70	1.70
Blue Springs and Wymore, Neb.	.20	1.65	1.65	1.55	1.45	1.40
Kansas City, Mo.	1.00	1.60	.....	.....	.....	.....

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Baltimore, Md.	.....	.90	2.75	2.50	2.00	1.75
Bernardsville, N. J.	.....	2.80	2.80	2.60	2.40	.....
Bound Brook, N. J.	1.00@1.10	2.00	1.80	1.70	1.50	.....
Branford, Conn.	.80	1.50	1.50	1.20	1.10	.....
Birdsboro, Pa.	1.40	1.90	1.80	1.60	1.40	1.40
Castro Pt., Richmond, Cal.	.50*	.....	1.50*	1 50*	1.40*	.....
Dresser Junction, Wis.	.50	1.75	1.75	1.55	1.50	1.50
Glen Mills, Pa.	1.00	1.35	1.70	1.55	1.35	1.35‖
Millington, N. J.	1.80	1.80	1.80	1.60	1.00	.....
New Britain, Conn.	.80	1.30	1.25	1.20	1.00	.....
Rock Hill, Pa.	1.00	1.35	1.70	1.55	1.35	1.35‖
Westfield, Mass.	.60	1.20	1.10	1.00	.90	.80
Winchester, Mass.	.75	.75	1.60	1.45	1.25	1.25‖

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Little Falls, N. Y.—Syenite	.80	1.20	1.40	1.20	1.20	1.20‖
Middlebrook, Mo.—Granite	3.50	.....	1.75	1.75	.....	1.00‡
Portland, Maine—Granite	1.50	.....	.....	1.35	1.25	.....
Roseburg, Ore.	.....	1.50	1.25	1.05	1.00	1.00
Stockbridge, Ga.—Granite	.50	2.00	1.90	1.75	1.75	.....
White Haven, Pa.—Sandstone	.85	1.20	1.40	1.20	1.20	1.20‖
Granite	1.25	.....	1.50	1.50	1.50	.....

*Cubic yard. †Agrl. lime. ‖R. R. ballast. ‡Flux. †Rip-rap. a 3-inch and less.

Agricultural Limestone Wholesale at Plant, per Ton

EASTERN:	
Coldwater, near Rochester, N. Y.—Analysis: $CaCo_3$, 56.77%; $MgCo_3$, 41.74%—80% thru 100 mesh; ppr., 4.50; bulk	3.00
Chaumont, N. Y.—Analysis: $CaCo_3$, 92 to 98%; $MgCo_3$, 1.51%—(Thru 100 mesh); ppr., 4.00; bulk	2.50
Paper bags	4.00
Cobleskill, N. Y.—Ppr., 5.00; bulk	3.00
Grove City, Pa.—Analysis: $CaCo_3$, 94.75%; $MgCo_3$, 1.20%—(70% thru 100 mesh); 80 lb. ppr., 4.60; bulk	3.25
Grove, Md.—90% thru 4 mesh; bulk	3,00
Hillsville, Pa.—Analysis, $CaCo_3$, 85%; $MgCo_3$, 1½%—(80% thru 100 mesh) in 80 lb. ppr. bags, 4.25; bulk	2.75
Jamesville, N. Y.—68% thru 100 mesh; 95% thru 50; 100% thru 20. Sacks, 3.75; bulk	2.25
Lime Kiln, Md.—50% thru 50 mesh; bulk	4.00
Pownal, Vt.—(50% thru 100) Analysis, $CaCo_3$, 90%; $MgCo_3$, 5%; ppr., $4.50; bulk	2.75
Rock Cut, N. Y.—Analysis, $CaCo_3$, 91%; $MgCo_3$, 5%—(90% thru 50 mesh)	2.50
Walford, Pa.—(70% thru 100 mesh; 85% thru 50; 50% thru 50; 100% thru 4); sacked, 4.25; bulk	2.75
West Stockbridge, Mass.—Analysis: Combined carbonate, 95%—33% thru 200 mesh; 66% thru 100; 100% thru 40. Bulk	2.85
Williamsport, Pa.—Analysis, $CaCo_3$, 88-90%; $MgCo_3$, 3-4%—(50% thru 50 mesh); bulk	3.00
Bags	4.50
CENTRAL:	
Alton, Ill.—Analysis: $CaCo_3$, 96%; $MgCo_3$, 0.75%—90% thru 100 mesh..	3.00
50% thru 50 mesh	2.00
Bedford, Ind.—(90% thru 10 mesh) Analysis, $CaCo_3$, 98.5%; $MgCo_3$, 0.5%	1.75
Canton, O.—50% thru 100 mesh; bulk	3.00
Bags	4.50
Chicago, Ill.—Analysis, $CaCo_3$, 53.63%; $MgCo_3$, 37.51%—90% thru 50 mesh	1.00
Columbia, Ill., near East St. Louis —(¼" down)	1.25@1.80
Ellettsville, Ind.—Analysis, Carbonate, 98%	2.00
Elmhurst, Ill.—(Analysis, $CaCo_3$, 35.73%; $MgCo_3$, 20.69%) 50% thru 50 mesh	1.25
Greencastle, Ind.—(Analysis, $CaCo_3$, 98%) 50% thru 50 mesh	1.75
Howenstein, O.—100% thru 10 mesh; 59% thru 50; 39% thru 100	2.75@3.00
Lannon, Wis.—(90% thru 50 mesh) Analysis, 54%, $CaCo_3$; 44%, $MgCo_3$	2.00
Marble Cliff, O.—(50% thru 100 mesh) Analysis, $CaCo_3$, 86%; $MgCo_3$, 8%..	2.50
Marblehead, O.—(Analysis: $CaCo_3$, 95.33%) 100% thru 100 mesh, sacks, 4.75; bulk	2.75
McCook, Ill.—Analysis, $CaCo_3$, 54.10%; $MgCo_3$, 45.04%—100% thru ¼" sieve; 78.12% thru No. 10; 53.29% thru No. 20; 38.14% thru No. 30; 26.04% thru No. 50; 16.27% thru 100	.90@1.00
Milltown, Ind.—Analysis, $CaCo_3$, 94%; $MgCo_3$, 3%	1.50
Montrose, Ia.—(90% thru 100 mesh)..	1,25
Mountville, Va.—Analysis, $CaCo_3$, 76.6%; $MgCo_3$, 22.8%—30% thru 100 mesh; 100% thru 20 mesh	4.00
Muskegon, Mich.—(90% thru 50 mesh) Analysis, $CaCo_3$, 53.35%; $MgCo_3$, 43.27%	2.50
Piqua, O.—Analysis: CaCo., 82.8%; $MgCo_3$, 8.2%; neutralizing power in terms of calcium carbonate, 95.3%—70% thru 100 mesh, bulk	2.50@4.00
Rockford, Ill.—Analysis, $CaCo_3$, 53.75%; $MgCo_3$, 44.35%	1.25
Stolle, Ill. (near East St. Louis on I. C. R. R.)—(Thru ¼" mesh) Analysis, $CaCo_3$, 89.61 to 89.91%; $MgCo_3$, 3.82%	2.00

(Continued on next page.)

Agricultural Limestone Wholesale at Plant, per Ton

(Continued from preceding page.)

St. Paul, Ind.—Analysis, $CaCo_3$, 85%; $MgCo_3$, 12%	1.50
Stone City, Ia.—Analysis, $CaCo_3$, 98% (90% thru 50 mesh)	.50
Toledo, O.—Analysis, $CaCo_3$, 52.72%; $MgCo_3$, 43%—(20% thru 100 mesh; 30% thru 50; 80% thru 100; 100% thru 5/32 screen)	1.80
Whitehill, Ill. — Analysis, $CaCo_3$, 96.12%; $MgCo_3$, 2.50%—	
90% thru 50 mesh, bulk	2.00
90% thru 100 mesh	5.00
SOUTHERN:	
Brooksville, Fla.—50% thru 50 mesh	2.80
Cartersville, Ga.—Analysis: 96 to 98% combined carbonates—All thru 10 mesh with all dust in	2.50
Dittlinger, Tex. — Analysis, $CaCo_3$, 99.09%; $MgCo_3$, .04%.	
90% thru 100 mesh	2.00
90% thru 4 mesh	1.00
Grovania, Ga.—Analysis, $CaCo_3$, 95%; $MgCo_3$, none—50% thru 100 mesh	3.25
Hopkinsville, Ky.—Analysis, 94.6 to 98.1% $CaCo_3$—Bulk	2.00
Knoxville, Tenn. (pulverized limestone) (90% thru 100 mesh)	2.50
Irvington, Ky.—(90% thru 50 mesh)	2.00
Memphis Jct., Ky.—(Analysis, $CaCo_3$, 95.31%; $MgCo_3$, 1.12%) average price	2.00
Mascot, Tenn.—Analysis, $CaCo_3$, 52%; $MgCo_3$, 38%.	
(80% thru 100 mesh)	2.50
(All thru 10 mesh)	2.00
80% thru 200 mesh	3.50
Paper bags, $1.50 extra per ton; burlap, 2.00 extra per ton.	
Maxwell, Va.	2.50
Ocala, Fla.—Analysis, $CaCo_3$, 98%—(75% thru 200 mesh)	4.50
Tyrone, Ky.—Analysis, $CaCo_3$, 93%; $MgCo_3$, 6%—90% thru 4 mesh	2.25
Winnfield, La.—(50% thru 50 mesh)	3.00
WESTERN:	
Colton, Calif.—Analysis: $CaCo_3$, 95%; $MgCo_3$, 1½%; bulk, 2.50; bags	3.50
Fresno, Calif.—(Analysis, $CaCo_3$, 94%; $MgCo_3$, .02%) 50% thru 200 mesh; 90% thru 100; 100% thru 40. Prices for delivery: Sacks, 6.50; bulk Sacks, 10c each.	6.00
Kansas City, Mo., Corrigan Sid'g—50% thru 50 mesh; bulk	1.35

Miscellaneous Sands per Ton at Plant

Silica sand is quoted washed, dried and screened unless otherwise stated.

GLASS SAND:	
Berkeley Springs, W. Va.	2.10
Special hand selected rock	2.50
Cedarville and South Vineland, N. J.—Glass, damp	2.00
Glass, dry	2.50
Gray Summit, Mo.	2.00@2.50
Guion, Ark.—Contracts	1.75
Carlots	2.00
Hancock, Md.—Engine and glass	2.50@3.00
Klondike and Pacific, Mo.:	
Contracts	2.00
Car lots	2.50
Mapleton, Pa.	2.50
Glass, damp	2.00
Massillon, Ohio	3.00
Michigan City, Ind.	.30@ .50
Millington, Ill.	1.75@2.25
Mineral Ridge, O.	2.75
Montoursville, Pa.—Green, washed	2.50@2.75
Oregon, Ill.	1.75@2.00
Ottawa, Ill.—Without contracts	2.00@2.50
Robinson, Md., washed, screened, not dried	2.00
St. Marys, Pa.—Green	2.50
Sands, Elk Co., Pa.—Selected, green	2.50
Thayer, W. Va.—Washed	2.50
Unwashed	2.00
FOUNDRY SAND:	
Albany, N. Y.—Core	1.50@2.25
Molding fine	2.50
Molding coarse	2.50
Brass molding	2.50
Sand blast	2.75@4.00
Allentown, Pa.—Core	1.50@1.75
Moldirng coarse	1.50
Arenzville, Ill.—Molding fine	1.50
Cedarville and So. Vineland, N. J.—Core, damp	2.00
Core, dry	2.50
Cleveland, O.—Core	1.00@1.50
Molding fine, molding coarse	1.75@2.25
Brass molding	1.50@2.50
Columbus, O.—Core	2.50
Furnace lining	2.50
Molding fine, steel molding	2.00

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, F. O. B., at producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 inch down	Sand, ¼ inch and less	Gravel, ½ inch and less	Gravel, 1 inch and less	Gravel, 1½ inch and less	Gravel, 2 inch and less
EASTERN:						
Ambridge, South Heights, Pa.		1.00		1.00	.80	.80
Attica, N. Y.	.65	.65	.65	.75	.75	.75
Concord Jct., Mass.	1.00	1.00	1.25	1.25	1.25	1.25
Farmingdale, N. J.		.75				1.50
Fishers Station, N. Y.			.65@ .75, all sizes			
Hartford, Conn.	.90		1.25	1.15	1.15	1.15
Morristown, N. J.	.60	.60	1.20	1.00	1.00	
N. Wilbraham, Mass.		.60*	1.25*		.90*	
Pittsburgh, Pa.		1.00	1.25	1.00	.80	.80
Washington, D. C.—Wharves	.75	.75	2.00	1.40	1.20	1.20
West Peabody, Mass.	.35@ .45	.35@ .45	2.00	1.20	1.20	1.20
Yardsville, N. J.			.50@ .75, all sizes			
CENTRAL:						
Alton, Ill.	.60@ .75	.60@ .75	1.50@4.50	1.30	1.20	1.20
Attica, Covington, Silverwood, Ind., Palestine, Ill.	.75	.75	.75	.75	.75	.75
Barton, Wis.	.85	.80	1.00	.80	.80	.80
Beloit, Wis.			.50 sand, .70 gravel			
Chicago		1.25@1.50	1.10@1.25	1.10@1.25	1.10@1.25	1.10@1.25
Columbus, O.		1.00	1.00	1.00	1.00	1.00
Covington, Ind.	.75	.75	.85	.75	.75	.75
Earlestead (near Flint), Mich.	.60	.65		1.20	1.00	.85
Escanaba, Mich.		.90	1.60	1.20	1.00	.90
Ft. Jefferson, Mechanicsb'g, O.	.50@ .60	.50@ .60	.50@ .60	.60@ .70	.60@ .70	.60@ .70
Grand Rapids, Mich.	.70*	.70*	1.35*	1.15*	1.00*	1.00*
Hersey, Mich.	.50			1.00	1.00	
Indianapolis, Ind.	.60	.60		1.50	.75	.75
Janesville, Wis.	.65	.65		.75		
Mason City, Ia.	.85	.75	1.65	1.60	1.50	1.40
Milwaukee, Wis.	.70	.70	.80	.80	.80	.80
Minneapolis, Minn.	.50	.50	1.75	1.75	1.50	1.50
Oxford, Mich.					.85	
Saginaw, Mich.	1.00	1.10	2.10	1.95	1.95	1.85
		(Includes freight rates .60 to .80 per ton)				
St. Louis, Mo., F. O. B. cars	1.20	1.25	1.50	1.30		1.25
Summit Grove, Ind.	.75					
Terre Haute, Ind.	.75	.75				
Toledo, Ohio			.60, all sizes			
Yorkville, Moronts, Oregon and Ottawa, Ill.	.75	.75	.75	.75	.75	.75
SOUTHERN:						
Knoxville, Tenn.	.85	.85	.85	1.50	1.50	1.25
Lake Weir, Fla.		.60				
Macon, Ga.		.75@1.00				
Memphis, Tenn.		1.25			1.50	
Pine Bluff, Ark.	1.25	.92		Concrete gravel 1.30		
Roseland, La., and Condron, Miss.		.50		1.00		
Thomas, La.	.60					1.75
Valde Rouge, La.		.80				1.25@1.50
Waco, Texas.		.70			1.10	1.10
WESTERN:						
Kansas City, Mo.	.60	.60	(Kaw river sand .60 per ton carlots)			
Lincoln, Neb. (on cars)	1.00	1.00	2.10	2.10		1.90
Pueblo, Col.	.80*	.60*		1.50*		
Roseburg, Ore.	1.50	1.00	1.25	1.25	1.00	1.00
San Francisco, Cal.	1.25	1.25	1.50	1.15	1.15	1.15
Saratoga, San Jose, Calif.		.60@ .75	.60@ .70	.60@ .70	.60@ .70	.60@ .70
Seattle, Wash.	1.25*	1.25*	2.00*	1.25*		1.25*
Vancouver, Wash.		1.10*		1.30*		1.10*
Yorkville, Ore.	.60	.60@ .75	.70	.60@ .75	.60	.50@ .60

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 inch down	Sand, ¼ inch and less	Gravel, ½ inch and less	Gravel, 1 inch and less	Gravel, 1½ inch and less	Gravel, 2 inch and less
EASTERN:						
Boonville, N. Y.	.60	.50@ .65				.65
Burnside, Conn.	.80*					
N. Wilbraham, Mass.	1.00*					
Yardville, N. J.		.50@ .75				
York, Pa.		.80@1.10	(crushed rock sand)			
CENTRAL:						
Attica, Covington, Silverwood, Ind., Palestine, Ill.	.60	.60	.60	.60	.60	.60
Escanaba, Mich.			1.00 cu. yd., all sizes			
Grand Rapids, Mich.	.60			.75		.60
Hersey, Mich.	.40			.50	.50	.50
Illinois, Northern						.50@ .60
Janesville, Wis.					.55	
Oxford, Mich.					.85	
Rockford, Ill.			Sand and Gravel mixed, .55@.65			
Saginaw, Mich. (Incldg. frt.)	1.40	1.40	1.40	1.40	1.40	1.40
Wabash Valley District, Ind.			.60 for all sizes			
Winona, Minn.			Pit run gravel under 2-in., .70			
Yorkville, Moronts, Oregon and Ottawa, Ill.	.60					
SOUTHERN:						
Albany, Ga.	.70@1.00					
Dudley, Ky. (Crushed Sand)	.95	.90		1.00		
Gravel Siding, Miss.			Mine run 45c per ton			
Knoxville, Tenn.	.90	.90	1.50	1.50	1.50	1.30
Lindsay, Tex.			Ballast pit-run gravel, .50 ton			
Pine Bluff, Ark.			Road gravel .45			
Thomas, La.						.40@ .70
Valde Rouge, La.						.60@ .75
Waco, Texas						.67
WESTERN:						
Pueblo, Col.		.60*		River Run, .60 unscreened		
Roseburg, Ore. (crushed stone)			1.35	1.25	1.15	1.00
Saratoga, San Jose, Calif.		.60@ .75	.60@ .70	.60@ .70	.60@ .70	.60@ .70
Yorkville, Ore.		.40			.40	

* Cubic yard. B Bank. L Lake. || Ballast.

Crushed Slag Wholesale at Plant Per Ton

City or shipping point	Roofing	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:							
Bethlehem and Emaus, Pa.	2.50	.85	1.50	.85	.85	.85	.85
Buffalo, N. Y.	2.00	.95	.95	.95	.95	.95	.95
Cleveland, Ohio.		.85		1.05	1.05	.95	.95
E. Canaan, Conn.	4.00	1.00	1.50	1.25	1.10	1.10	1.10
Erie, Pa.	1.75	.85@1.00	1.00@1.50		1.00	1.00	1.00
Emporium, Pa.		1.00	1.00		1.00	1.00	1.00
Ensley, Ala.	2.05	.90		.90@1.20	1.00	.90	.85
Hokendaugua and Topton, Pa.	2.50	.85	1.50	.85	.85	.85	.85
Lebanon (Donaghmore), Pa.	2.50	.85	1.50	.85	.85	.85	.85
Philadelphia Dist.	2.50	.75	1.50	.85	.85	.85	.85
Pittsburgh, Pa., Dist.	2.05	1.10	1.50	1.10	1.10	1.10	1.10
Sharpsville, Pa.	1.75	1.00	1.25	1.00	1.00	1.00	1.00
CENTRAL:							
Chicago, Ill.	All sizes, $1.50, F. O. B. Chicago						
Detroit, Mich.	All sizes, 1.65, F. O. B. Detroit						
Ironton and Jackson, O.	**2.00**	**1.25**	**1.50**	**1.25**	**1.25**	**1.25**	**1.25**
Toledo, O.	All sizes, 2.00, F. O. B. Toledo						
Youngstown, Sharpsville, Hubbard, Leetonia, O.	2.00	1.10	1.50	1.10	1.10	1.10	1.10

Agricultural Lime and Hydrate at Plant Per Ton

	— Agricultural Lime— Bulk	Bags	Per Cent CaO	Per Cent MgO	Agricultural Hydrate Bags
EASTERN:					
Adams, Mass.		7.50@8.00	65		
Apollo, Pa.	3.25		95.14	1.44	
Berkeley, R. I.		14.00	45	15	
Bellefonte, Pa.	**7.25**		**95.5**	**.72 to .89**	
Bridgeport, Pa.	7.50		55	44	10.50
Cavendish, Vt.		2.50 bbl. in car lots			
Cavetown, Md.	**8.50**				
Cedar Hollow, Devault, Rambo and Swedeland, Pa.	8.00	10.75 grd.	58	38	10.75
Chippewa, Pa.	5.50@6.00		78.67	1.33	
Espy, Pa.	**4.50**		**82**	**1.25**	
Farnams, Mass.	5.00	7.50			
Frederick, Md.	7.75		88	5 to 8	10.50
Grove City, Pa.	3.25	4.50	94.75	1.20	10.25
Grove, Md.	8.00				**10.75**
Highgate Springs, Vt.		8.00	85	2	
Hollidaysburg, Pa.	6.50		94.25	.30	
Hyndman, Pa.	5.00	8.50	80.23	2.87	
Lime Bluff, Pa.	**5.00@6.25**		**78.67**	**1.33**	
Lime Kiln, Md.	8.00	10.75			10.75
Lime Ridge, Pa.	5.00@6.25		80.56 to 62.56	3.87 to 1.75	
Mt. Union, Pa.	4.25		94.6		
Newburgh, N. Y.			57	38	8.00
New Castle, Pa.	3.50	4.50	47.6 to 50.4	0.62 to 1.12	
Ottawa, Ont.	**12.00**		**95**	**1.5**	
Paxtang, Pa.	5.00		60	12	
Rosedale, N. Y.	8.00		96	5	(Bulk, 6.00)
Sandville, O.					9.00
Steuben, Pa., Dover Plains, N. Y., York, Pa.		7.00@9.50	70		10.75 to 12.00
Union Bridge, Md.	8.50		73	1	10.75
West Rutland, Vt.	**5.00**	**7.50**	**68**	**3**	**10.00**
Williamsport, Pa.	5.50	10.00	65 to 80	2 to 4	10.00
Williams Station, Pa.	7.50		60.6	39.1	9.75@10.50
York, Pa.	8.00		90 to 95	2 to 7	10.75
Zylontte Station, Adams, Mass.		8.00			
CENTRAL:					
Alton, Ill.	10.90		94.0		
Delaware, O.			61.09	9	9.75
Forest, O.	**7.50**				
Manistique, Mich.		10.00	54 & 95	40 & 1.75	10.00
Marblehead, Ohio			54	16.0	9.75
Mitchell, Ind.	**9.00**				**11.00**
Springfield, Ohio			33.62	17.73	9.75
Woodville, Ohio		9.25	46 to 48	30 to 34	10.25
SOUTHERN:					
Blowers, Fla.	5.00	7.25	98.0		
Burns, Tenn.	9.00		96	0.54	12.00
Chippewa, Fla.	5.00		80.0	15.0	
Erin, Tenn.	8.00		97.82	0.12	
Karo, Va.	8.00		97.0	1.26	
Lineton, Va.	8.50		**97**	**1.74**	
Louis Brook, Va.	8.00	10.25	90	1	
Lushing, Va.	9.00	11.25	60	15	12.75
Maxwell, Va.	5.00		84	1.75	
Newala, Ala.	**8.50@9.00**		**99.33**		
Ocala, Fla.	**4.00**	6.00 pulv.	**98½ (dry basis)**		
Staunton, Va.	7.50		96.48		
WESTERN:					
Bellins, Wash.					12.00
Colton, Calif.	4.50		56.0		
Dittlinger, Texas		9.00@11.00	98.62	0.29	12.50@15.00
Kirtland, N. M.	10.00				
Knowles, Wis.	8.00	9.50	55	45	9.50
Lime, Ore.	**15.00**		**91.48**	**0.58**	
Oscas Island, Wash.		5.50			16.50
San Francisco, Calif.					15.00
Tehachapi, Cal.	**6.00**	**8.00**	**96**	**2**	

Miscellaneous Sands per Ton

(Continued from preceding page)

Conneaut, O.—	
Molding fine	2.75@3.00
Molding coarse	2.50@2.75
Delaware, N. J.—Molding	1.50@2.00
Dundee, Ohio—Molding, steel	1.75
Eau Claire, Wis.—Core	2.25
Brass molding and sand blast	2.25
Fleetwood, Pa.—Furnace lining	2.25
Franklin, Pa.—Traction	2.25
Brass molding	2.75
Molding fine, steel molding	2.00
Molding, coarse	2.00@2.50
Sand blast	3.50
Core	2.00
Klondike and Gray Summit, Mo.—	
Molding fine	1.50@2.50
Greenville, Ill.—Molding coarse red	1.60@1.80
Guion, Ark.—Filter	2.50
Hancock, Md.—Core and brass mldg.	1.65
Hellam, Pa.—Core	2.00
Joplin, Mo.—Stone sawing, flint	1.25
Kansas City, Mo.—Missouri River core	.85
Leesburg, Pa.—Core, furnace lining, molding fine and coarse	2.00
Mapleton, Pa.—Molding, fine and core, damp	2.00@2.50
Molding, fine, dry	3.00
Massillon, O.—Steel molding coarse	2.50
Molding fine	2.50
Molding coarse	2.50
Traction	2.50
Furnace lining	3.00
Core	2.50
Michigan City, Ind.—Core, bank	.40@ .50
Millington, Ill.—Furnace lining, roofing, stone sawing	1.50@2.00
Core	1.50
Mineral Ridge, O.—Core, molding, sand blast, roofing, brass molding, etc., washed, screened (damp)	2.10
Montoursville, Pa.—Core	1.50@2.00
Molding fine	1.50@2.00
Traction	1.25@1.75
Brass molding	2.00@2.50
Ohio—Various points:	
Iron molding, fine	1.50@2.25
Iron molding, coarse	1.75
Brass molding, minimum	2.00
Oregon, Ill.—Core	2.00@2.50
Furnace lining	2.00@2.50
Sand blast	2.75
Ottawa, Ill.—Sand blast	3.00
Core, furnace, steel molding	2.50
Roofing sand, molding coarse	2.50
Stone sawing, traction	2.50
Brass molding	2.00@2.50
Providence, R. I.—Molding fine	2.00
Molding coarse	1.90
Brass molding	2.25
Sand blast	3.00@4.00
Sugar Grove, Ohio—Core (dried and screened)	2.00
Traction	2.00
Thayers, Pa.—Core and traction	1.75@2.00
Furnace lining, molding	1.25
Utica, Pa.—Core	2.00
Molding coarse, steel	2.00
Traction	2.00
Brass molding	2.00
Warwick, O.—Core	2.25
Furnace lining	2.25
Molding fine	2.25
Molding, coarse	2.25
Traction and brass molding	2.25
Wedron, Ill.—Core, (crude silica)	.75@1.00
Furnace lining, molding fine	.75@1.00
West Albany, N. Y.—Molding fine	**1.75@2.25**
Molding coarse	1.50
Brass molding	1.75

Gypsum, per Ton, at Plant

Castalia, O.—Crushed, to cement mills	3.50
Ground, to cement mills	3.50
Land plaster	6.00
Fort Dodge, Ia., bulk	3.50
Garhutt, N. Y.—Land plaster, bags	7.00
Grand Rapids, Mich.—Crushed gypsum	7.00
Ground gypsum rock	9.00
Gypsumville, Man., Can.	3.00
Oakfield, N. Y.	7.00
Sandusky, O.	6.00

Jute sacks, $3.00 extra; paper, $1.00 extra.

Ground Rock Phosphate at Plant, per Ton

Centerville, Tenn.—B. P. L., 60% to 70%; ton, 2240 lbs. Ground rock phosphate (90% thru 100 mesh)	9.00@10.00
Lump rock, 72% to 75%, B. P. L.	6.00@8.50
Centreville, Tenn.—B. P. L., 60%	7.00
B. P. L., 60% to 70%	7.00@9.00
Gordonsburg, Tenn.—B. P. L., 72%; ton, 2240 lbs. Ground 90% thru 100 mesh	7.00@9.00
Lump rock	6.00@7.50
Mt. Pleasant, Tenn.—(B. P. L., 68%) 12%	6.00
13%	7.00
14%	8.00
Mt. Pleasant, Tenn.—B. P. L., 60% to 70%	8.00@9.50
Nichols, Fla.—Pebble, B. P. L., 70%	10.00
Wales, Tenn. (95% thru 100 mesh) (guaranteed 14% phosphorus equivalent)	8.25
Walls, Tenn.—B. P. L., 70.2%—	
To County Agri. Assns.	7.50
To others	7.75

Florida Soft Phosphate

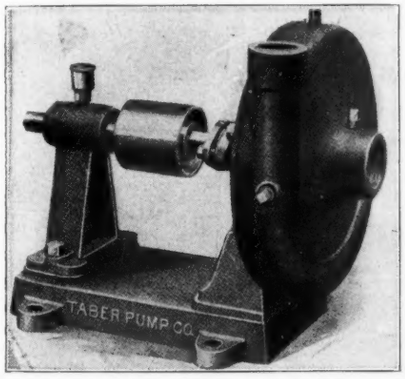
Croom, Fla.—Ground pebble, 30%	16.00
Pulverized soft, 26%	17.50
Jacksonville (Fla.) District	10.00@12.00
(Add 2.50 for sacks)	
Phoslime, Fla. (in burlap bags, 100-200 lbs.)	15.00
Benotis, Fla.	9.00@11.00

NEW MACHINERY AND EQUIPMENT

New Line of Centrifugal Pumps

A LINE OF SINGLE SUCTION open impeller type of centrifugal pumps has been placed on the market recently by the Taber Pump Co., Buffalo, N. Y. These pumps are designed to supply water to crushed stone and sand and gravel plants, not for pumping sand. They are made in both belt-driven and motor-driven units, and in sizes from one to 6 in. They are particularly designed for heads from 50 to 75 ft., but can be used for 100-ft. heads.

These pumps are made with center suction and tangential discharge. The discharge is so placed that pipes can be connected vertically, horizontally or swung through an angle of 90 degrees on the supporting yoke, which allows considerable flexibility in the placing of the pump in the plant. The stock pumps are made of cast-iron, but for special requirements bronze composition can be supplied.



Impeller type of centrifugal pump

Impeller of the Taber pump

Hydraulic Motor-Truck Hoist

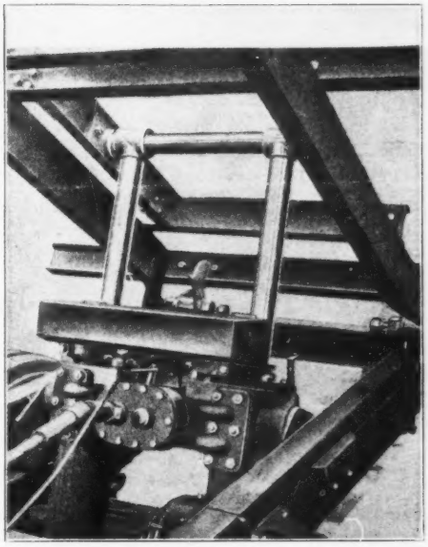
THE HEIL CO., Milwaukee, Wis., has placed on the market a power hydraulic hoist, illustrated in the accompanying view.

It is mounted on the chassis frame in front of the rear axle about in line with the front hanger of rear spring shackle. It consists of a vertical cylinder or cylinders, depending on the make of the truck, containing pistons driven by a gear pump. The power to drive the pump is taken from the front propellor shaft or from the amidship transmission and is applied by operating a lever in the driver's seat.

The hoist is swung from saddles so that it can give a direct lift at all times on the body.

The oil is driven by the pump from the upper part of the cylinders through oil ways to the bottom of the cylinders, thus forcing the pistons up. The hoist automatically stops when it reaches its full stroke.

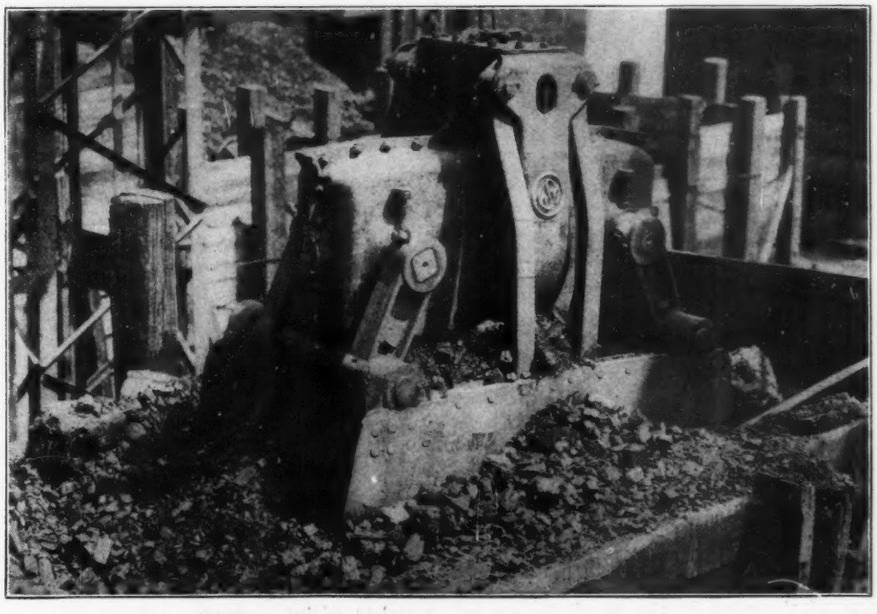
To lower the hoist a valve operated from the driver's seat is opened, which allows the oil to by-pass back into head of the cylinder. As the piston stands on a solid head of oil, which oil must be displaced by passing through this valve the body can come down at only one rate of speed. This is an important safety feature. It is claimed that one can work around or under a body equipped with a hoist and be perfectly safe.



Heil motor-truck hoist

New Geared Grab Bucket

THE WELLMAN-SEAVER-MORGAN CO., Cleveland, Ohio, has recently put on the market the Wellman geared bucket, which is illustrated herewith. This grab bucket differs from some others in that its digging mechanism is completely inclosed. This makes the bucket suitable for handling sand, gravel, or other abrasive materials since there is no possibility of the material handled cutting the driving parts. Also, inclosed gears may be easily lubricated.



Wellman-Server-Morgan geared grab bucket

General News From the Rock Products Markets

Texas Has Big Boom in Road Building

AUSTIN, Texas—No previous year will begin to compare with that of 1919 in the matter of amount expended in Texas for the construction of highways. It is shown by the records of the State Highway Department that for the eleven months to Dec. 1st a total of $80,457,000 bonds had been voted by counties of Texas, the proceeds used and to be used in the construction of good roads.

In addition to this sum, bond issues amounting to $33,568,000 are under consideration. Added to the bonds is a fund obtained from motor vehicle licenses amounting, up to December 1st, to $1,381,308.76, and a federal good roads fund of $10,175,806.31 for the year 1919-1920.

Construction of highways in Texas during the last several months has been greatly retarded by long periods of unprecedented rains and a general shortage of labor. Many counties. however, have purchased good roads equipment, in the way of tractor engines and graders and are prepared to carry on an extensive program of improvement during the next several months.

The proposition of amending the constitution so as to authorize the issuing of $75,000,000 bonds, the proceeds to be used in building good roads was defeated at the recent election, but this has not deterred the different counties for voting bonds for the purpose.

California Road Building Plans for Next Year

OAKLAND, Calif.—The year 1920 will be a very busy one in state highway work if the money markets are favorable for the sale of state highway bonds, if the United States Railroad Administration will assign enough freight cars to supply the contracts with the necessary materials, if the supply of labor does not run short, and if the wage of labor becomes more nearly fixed than at present.

Notwithstanding these conditions, the California Highway Commission has made its plans to build state highways in 1920 at the rate of about $800,000 a month, a total of $10,000,000.00 for the year. But the bonds must be sold first before the contracts may be advertised, and the labor conditions must be stabilized or the engineers cannot estimate nor can the contractors bid intelligently.

The earliest work will be the completion of the gaps in the trunk lines and the work on the county seat laterals. The year 1920 will doubtless see completely paved the coast route from San Francisco to San Diego and the valley route from San Francisco via Sacramento to Los Angeles, and the Commission is now engaged upon the study of the pavements through the incorporated cities and towns.

The largest southern California project, Oxnard to San Juan Capistrano, estimated to cost about $4,000,000, has four survey parties employed.

While, as already stated, the earliest work will be that of completing the roads contemplated by the first and second bond issues, it seems probable that some of the $40,000,000 in roads will be under contract next year.

Bear These Dates in Mind!

FEBRUARY 10, 11 and 12, the National Crushed Stone Association meets at the Seelbach Hotel, Louisville, Ky.

FEBRUARY 11 and 12, the National Association of Sand and Gravel Producers meets at the Sherman Hotel, Chicago, Ill.

THESE mineral aggregate industries face the biggest year yet, but they also face the biggest problems ever met with. Don't try to meet these problems singlehanded. Join the crowd with the "big stick."

Texas Cement Industry Expands

HOUSTON, Texas—Plans have been adopted by the Texas Portland Cement Co., Houston, to enlarge its cement plant from 1,000 barrels to 3,000 barrels daily capacity. The improvements will consist of a new large kiln, a new warehouse and wharf. The company, it is stated, has in view a big expansion of its export trade.

According to reports of the different cement manufacturers of Texas, the demand for their product for domestic purposes shows a considerable increase over what it was a few months ago. Building activities all over the state are reviving and large projects that were deferred during the war are now about to be carried out. It is stated that several very large irrigation projects are on foot. This will require the construction of a number of large concrete dams.

Active Winter Construction Reported at Memphis

REPORTS from Memphis indicate that 1919 will be recorded as an unusually busy year in the construction field.

Building permits in Memphis for the first eleven months of 1919 aggregate $6,512,200. The permits for November, 1919, were $495,000; both are relative gains. This will cause considerable work to be done this winter and, in fact, a number of large and important projects are under way.

A lack of proper transportation facilities has impeded the movement of cement, lime, sand and gravel and other building material and the construction under way has been hampered considerably.

Besides the building under way, the 1920 road-building program will cause a heavy drain on aggregates supply. A plan for a north and south central market highway, running through Ashland. Hickory, Flat, Pittsboro, and Pascagoula, Miss., has been proposed, but not definitely decided upon.

Twenty-seven miles of road near Memphis have been contracted for to be built of slag; this will require about 40,000 cu. yds. of material. Several other shorter stretches of hard surface road are also under construction.

Building Report Shows Gain for 1919, but November Loss

UNPRECEDENTED gain of 717 per cent over 1918 operations counterbalanced in optimistic effect by a slump from October activity in 63 per cent of the 193 cities reporting to The American Contractor, is the significant index of operations as shown by November permits.

The activity by months for 1919 and 1918 brings out clearly the steady increase in this year, which reached its peak in August, contrasted to the early waning of activity in May. 1918.

Only six cities show a less estimated valuation of November permits for this year than last year, but 63 per cent show losses from October.

There are no special areas of gains or losses, the fluctuations being distributed throughout all the states. Virginia is an exception, all of its cities showing gains. In Ohio every city excepting one shows a loss. In some cities the recession is very marked, and in general the fluctuation is less in the most important cities, which in itself is a hopeful sign for further continuance of activity.

Incorporations

The **Toccoa Traprock Co.**, 303 Walton Building, Toccoa, Ga., has been incorporated.

The **Pennsylvania Lime Products Co.**, Philadelphia, has been incorporated with a capital of $5,000.

The **Kemp Bend Co.**, Wilmington, N. Y., has been incorporated to acquire and operate quarries. The capital is $350,000.

The **Acme Sand and Gravel Co.**, Wilmington, N. Y., has been incorporated to mine, buy and sell sand and gravel. The capital is $100,000.

The **Howland Quarry Co.**, Rockaway, Conn., has been incorporated to operate quarries. The capital is $100,000. Incorporators are Jessie Howland, A. J. Howland and J. E. Howland.

The **J. K. Davison and Brother Corporation**, Pittsburgh, Pa., has applied for charter to mine and quarry sand and gravel and for the purpose of owning and operating dredge boats and barges.

The **Royal Oak Sand and Gravel Co.**, Highland Park, Detroit, Mich., has been incorporated for $35,000, to deal in sand and gravel and building material. The incorporators are H. S. Gardner, M. Kohn, and Henry Kohn.

Lime

The **Empire Lime Kilns**, Bellefonte, Pa., has been dissolved, according to Conrad Miller, and The Valley View Lime Kilns has been organized in its place.

The **St. Paul Stone Co.**, Hastings, Minn., has been reported to be the purchaser of the McDermott tract across the river from Hastings. The company will extend their crushed stone operations by installing a crusher plant on the new site.

The **Delaware Blue Limestone Contracting Co.**, Delaware, Ohio, has remodeled its plant to use electricity throughout. It is believed that this change will make a smoother running plant and that the number of men required to operate will be reduced.

The **Texas Stone Co.**, located on the Morris spur, south of Chico, Texas, is putting in new machinery, and when constructed will be one of the largest and most modern stone-crushing and cement plants in the South. This company is incorporated with a capital of $475,000, and when completed will put out daily, in addition to its present output of 20 cars, some 50 to 60 cars.

The **Lone Star Stone Co.** is installing a new plant for crushing stone, just east of Chico, Texas. The spur to serve same is now being built from the Rock Island Railroad to the new plant. Some of the supplies have already arrived for this enterprise, foundations being placed, and it is expected by early spring that this plant will be in a position to turn out fifty cars of crushed rock daily.

The **Sheboygan Falls Limestone Co.**, Sheboygan, Wis., has offered for sale to the county board of supervisors its entire property of 19 acres, with all the buildings thereon, together with crushing machines. There is a sufficient supply of suitable stone for road building located in the quarry on this land to furnish the county with stone for many years to come. An inspection will be made of the premises by the supervisors before definite action is taken.

The **Suffield-Berlin Trap Rock Co.**, of Hartford, Conn., increased its capital from $800,000 to $1,000,000. The common stock is increased from $400,000 to $500,000 and the common shares from 16,000 to 20,000. The preferred stock is increased from $400,000 to $500,000, and the preferred shares from 16,000 to 20,000, making the total number of shares 40,000 instead of 32,000, all of the par value of $25 each. The directors signing the certificate are J. E. Hastings, president; J. L. Warner, treasurer, and H. M. Steele.

The **Monmouth Stone Co.** received word recently that steel for the building of two sidetracks at the company's quarry near Gladstone, Ill., had been shipped and that work on the tracks would be started soon. Engineers have completed the preliminary work and as soon as the rails arrive the steel gang will be started laying the two tracks. When completed these two tracks will accommodate 70 cars. The company has also received word that its steam shovel had been shipped and that it will probably arrive at the quarry in a few days. Arthur Stenstrom, the company's chief engineer, will supervise the erection of the steam shovel equipment. The Stone company will turn out its first shipments of crushed stone as soon as the tracks are laid and the big steam shovel is placed in operation.

Retail Dealers

The **Building Material Co., Biloxi, Miss.**, has been incorporated with a capital of $30,000 to deal in building material of all kinds.

The **Tidewater Coal and Supply Co.**, Hackensack, N. J., has been incorporated with a capital of $125,000 to deal in coal and building materials.

The **Giant Concrete Pile Co.**, Manhattan, New York City, has been incorporated with $10,000 capital. The incorporators are B. Schreiber, H. W. Nassberg and K. McGlyn.

The **J. G. Johnson Co.**, Manitowoc, Wis., retail dealers in fuel and masonry supplies, announce the change to The Spindler Co. The new president is C. F. Spindler, and the stock of the company is $85,000.

The **Lynn Builders' Supply Co.**, Lynn, Mass., has been incorporated to deal in builders' supplies. The capital is $50,000. Directors are J. J. Leonard, president; W. H. Murphy, treasurer, and T. J. Lee.

The **American House Co.**, Milwaukee, Wis., has been incorporated with $1,000 capital, to do general building and deal in building material. The incorporators are A. L. Richards, E. O. Kissinger and H. A. Richards.

The **Martin Coal Co.**, Darlington, Wis., has been incorporated with $10,000 capital, to do wholesale and retail dealing in lime, cement, building material and coal. The incorporators are J. F. Martin, C. F. Martin and M. E. Martin.

The **Beloit Brick Co.**, Beloit, Wis., has been incorporated with a capital of $25,000, to do a general concrete manufacturing business and to deal in building material. The incorporators are G. E. W. Marsden, T. C. Hendley and W. H. Wheeler.

The **Badger Hydro-Stone Co., Milwaukee, Wis.**, has been incorporated with a capital of $25,000 to manufacture concrete blocks and a special patented product known as hydro-stone blocks. The incorporators are P. O. Powell, T. J. Jennings and A. A. Eggers.

The **Long Beach Cement Products Co.**, Long Beach, Cal., is installing machinery and equipment to manufacture all cement products. A. F. Haggren, manager, has had 18 years' experience in this field of work, and states that the business prospects are unusually good.

The **Waukesha Cement Tile Co.**, Waukesha, Wis., has been incorporated with $60,000 capital, to deal in cement and building material and to manufacture and deal in cement and clay products. The incorporators are: J. H. Waite, T. G. Wilder and E. M. Wilder.

The **Light Sandless Concrete Co.**, Des Moines, Iowa, has been incorporated with $300,000 capital to manufacture concrete products of all kinds. The incorporators are C. H. Light, president; E. E. Moore, vice president; W. H. Moore, secretary, and R. H. Fowler, treasurer.

The **Lebanon Cement Block Co.**, on West Elm Street, Lebanon, Ind., recently owned by James Parish and William Yelton, has been purchased by L. D. Shannon for $5,000. Mr. Shannon will move his old factory on North East Street to the new business, which will increase the production of the company under new management.

Cement

Alsen's American Portland Cement Works, main offices in New York City, reports that the largest single sale ever made of Alsen's cement was recently made to the United Hudson Electrical Corporation; 26,000 bags of cement are to be used in the construction of a hydro-electric plant.

The **International Cement Corporation**, Portland, Me., has been incorporated for the purpose of quarrying and preparing for the market limestone, rock, clays, coal, ores and all kinds of minerals. The capital is $2,000,000. The incorporators are R. S. Johnson, president; H. I. Smith, treasurer, and A. B. T. Farnham, clerk.

The **Cement Export Co.**, an association of 11 portland cement manufacturers, whose annual production approximates 15,000,000 bbls., has elected the following officers: President, Charles S. Conn, Giant Portland Cement Co.; first vice-president, Joseph A. Horner, Nazareth Cement Co.; second vice president, J. W. Alker, Pennsylvania Cement Co.; secretary, Morris Kind, Hercules Cement Corporation; treasurer, Joseph Brobston, Dexter Portland Cement Co., and general manager, F. C. Green. The association has secured terminal facilities in New York City for the storage of about 50,000 bbls. of cement. From 5,000 to 50,000 bbls. will be kept in stock so that all orders can be promptly filled. Representatives of the export company have left to develop the export market in the Argentine Republic and in Brazil.

Quarries

The **Bessemer Limestone Co.**, Youngstown, Ohio, has made the announcement through F. R. Kanengeiser, vice president and general manager, that the company has broken ground for the erection of a new cement plant. The Allis-Chalmers Manufacturing Co., Milwaukee, Wis., is furnishing the equipment and have completed the plans but the Bessemer Limestone Co. is doing the constructional work. It is expected that the plant will be ready for operation about Sept. 1, 1920. R. J. Hawn, who has been with the Virginia Portland Cement Co. for 15 years, has been engaged as superintendent of the new plant. Charles Schmutz, who has been with the Crescent Portland Cement Co., for a number of years, will be sales manager. The "Bessemer" brand of cement will be the product.

The **Rock Products Co.**, Easton, Pa., was incorporated in the State of New Jersey, with a capital of $125,000. The Board of Directors consist of D. H. Schweyer, R. T. Brewer, F. L. Way and C. T. Brewer, all of Easton, Pa., and W. H. Walters of Phillipsburg, N. J. The officers are: D. Herbert Schweyer, president; Rollin T. Brewer, vice president and secretary; Fred L. Way, treasurer. The company was organized by D. H. Schweyer and R. T. Brewer, who were owners of various quarry interests in this vicinity, and had recently purchased the Lizzie Clay & Pulp Co., of Phillipsburg, N. J., which had been engaged in the manufacture of reck products since 1870. The Rock Products Co. is engaged in grinding soapstone and clay and producing terrazzo and granite. This latter material is of a beautiful green color and due to the soft nature of the marble from which it is made is particularly adaptable for use in ornamental floors. The company also has deposits of ornamental serpentine which is sold in the block and is used in statutary work, altars, pedestals, wainscote, cap and base, etc. D. H. Schweyer was formerly manager of the H. A. Schweyer Co., producers of serpentine green and Pennsylvania green marble. R. T. Brewer was formerly an engineer with the Franklin Automobile Co., Syracuse, N. Y. The other directors are business men in Easton, Pa., and Phillipsburg, N. J.

Manufacturers

The **Fairbanks, Morse & Co.**, Chicago, Ill., manufacturers of machinery, and machine supplies, is erecting a large modern foundry at Beloit, Wis. The new plant, which will possibly be the largest and most complete of its kind in the country, will cover about 11 acres and will cost $1,500,000. Aside from the equipment for production, special stress and expense is being expended to make the factory unusually attractive and pleasant for the 3,000 men which will be employed there.

The **Ball Engine Co.**, Erie, Pa., manufacturers of steam and electric shovels, railroad ditchers, locomotive cranes, drag line excavators, etc., have ready for circulation bulletin 536, which features the tractor mounted Erie shovel, as used for loading rock. The views of this little booklet show the shovel as it is now appears at work in the various quarries over the country. The Erie shovel is featured as an excavator, which can stand up under unusual conditions, such as are met in all quarries.

CHRISTMAS GREETINGS
to all our readers and advertisers—our friends and coadjutors in making Rock Products helpful to the industry.

CLASSIFIED ADVERTISING

Rates for advertising in the Classified Department: 2.50 per column inch per insertion. Minimum charge, $2.50. Please send check with your order. These ads must be paid in advance of insertion.

Plants For Sale

FOR SALE

LIMESTONE PROPERTY consisting of approximately 100 acres, estimated to yield a very considerable tonnage of exceptionally high grade stone, suitable for burnt lime, hydrated and agricultural purposes. Situated on Southern Railway in heart of Piedmont section of N. C., and approximately 200 miles from nearest lime quarry. For further particulars, address

P. O. Box 743 Winston-Salem, N. C.

FOR SALE

STONE QUARRY

Good Railroad Facilities
Best Grade Sand Stone

JOHNSTON HALL, Oil City, Pa.

Help Wanted

WANTED

Mill Foreman, Master Mechanic, one familiar with operation and general repairs in large Eastern jaw crushing plant. Must also be familiar with Steam Shovels, Locomotive Cranes, and Internal Combustion Engines as used in Cyclone Well Drills. State salary expected, references and when available. Address

Box 1347 Care of Rock Products

WANTED

Superintendent for large wash sand and gravel plant, one who is competent for production, mechanical ability for supervision, maintenance, and continuous production. Address

Box 1348 Care of Rock Products

WANTED

Superintendent of proven executive ability to take charge of large electrically operated quarry and sand plant, generating own power with B. & W. water tube boilers. Must understand piston and centrifugal pumps. Operation continuous throughout the year. Address

Box 1349 Care of Rock Products

Situation Wanted

WANTED

Position as New England salesman for firm producing rock products (cement, lime, crushed stone, sand or gravel). Extensive experience in handling above materials in the New England territory.

JAMES M. COSGROVE
108 West Street Malden, Mass.

You are reading this ad. So are others. That is why it will day you to advertise in these columns.

Prompt attention will be given your inquiry if you mention ROCK PRODUCTS

Getting Off to a Good Start in 1920

Your sales records at the finish of the year depend in a large measure on the start you make at the beginning of the year.

The Rock Products Industry is Rich in Opportunities to Increase Sales in 1920

According to the Secretary of the National Association of Sand and Gravel Producers, 275,000,000 tons of sand, gravel, crushed stone and slag must be produced in 1920 to meet construction needs.

The U. S. Bureau of Public Roads estimates $633,000,000 available for expenditure in highway construction in 1920.

Professor Bear, of the Ohio Agricultural Experiment Station, says 2,500,000 tons of agricultural limestone required in Ohio alone—other states in proportion.

Similar big totals register the demand for cement, phosphate and other products of this vast basic industry.

A Summary of the Present Condition of These Industries Will be Given in the

ANNUAL REVIEW AND FORECAST

January 3, 1920, issue of

Rock Products

The Nation's Authoritative Business Journal of the Rock Products Industry

Tell your sales story in this big, timely special issue. You will reach the largest audience of buyers ever assembled, and their pressing needs for maximum output assures you their attention.

Don't neglect this opportunity to develop business—nothing else will have an equally stimulating and profitable effect upon sales in 1920. Get your reservation in early. Space limited. Rates reasonable. What size advertisement will you carry in the Forecast and Review Special Number? Send in your data—our Service Department will prepare the advertisement and render proof for your Okay if you desire.

Rock Products, 542 South Dearborn Street, Chicago

USED EQUIPMENT

Rates for advertising in the Used Equipment Department: $2.50 per column inch per insertion. Minimum charge, $2.50. Please send check with your order. These ads must be paid in advance of insertion.

FOR QUICK SALE OR RENT

Thew steam shovel, ⅝ yd. traction.

Bucyrus steam traction, ½ yd.

Bucyrus 2½ yd. standard gauge 65 ton R. R. shovel.

Laidlow Dunn Gordon rotative vacuum pump.

Sturtevant pulverizer.

Climax geared locomotive, 40 ton stand. gauge.

Shay geared locomotive, 20 ton stand. gauge.

D. B. STRALEY
Crown Point, Ind.

FOR SALE

1—No. 3 Jeffrey pulverizer, good shape.
1—Open-door Sturtevant mill, good shape.
1—15-h. p. Foos gas engine, fine shape.
1—25-h. p. motor, good.
1—600-bu. lime tank, new.
1—25-ft. Champion elevator, new.

JOHN J. CANNON
P. O. Willow Grove, R. F. D., Montg. Co., Pa.

Contractors' Equipment
Of All Kinds

Here's a Special:

4—Brand New 7x10 American D. C. D. D. Hoisting Engines with butt-strapped Boilers.

Also a number of used hoists.

ZELNICKER IN ST. LOUIS

Get our new Bulletin No. 270. 60 pages of unusual values in Rails, Locomotives, Cars, Cranes, Boilers, Wire Rope, Hoists, etc.

New—RAILS—Relaying

All sections on hand for quick shipment. Reasonable prices quoted. Our stock is very complete.

M. K. FRANK
Frick Building Pittsburgh, Pa.

WANTED

Used Brown Locomotive Crane or Bay City. Must be in A1 shape.

YORK SAND & GRAVEL, LIMITED.,
East Toronto, Ont., Canada

FOR SALE

20—Crushers, Nos. 2 to 10, mostly Gates.
2—327 HP. W. T. boilers, 180 lbs. $9.50 HP
9—150 HP. 125-140 lb. HRT. boilers (B. strap).
1—No. 10K Gates Manganese fitted crusher, $6500.
1—No. 9K Gates Crusher, Mang. R. A. D. $5500.
1—No. 4 crushing plant, motor drive.
1—No. 3 crushing plant, engine drive.
2—48"x12' Taylor Manganese screens.
25—Air Compressors, 60 to 4000 cu. ft.
50—Steam engines, 30 to 1500 HP.
1—150 KW. 250 V. D. C. Turbo. Non-Cond.
1—30 KW. 125 V. Crocker Wheeler Eng. Set.
2—30x13 and 1—20x6 Jaw Crushers.
3—AC Generators, 240 V. 3 Ph. 75-100-125 Kva.

Send us your inquiries for electrical equip., pumps, engines, hoists, cable.

ROSS POWER EQUIP. CO.
Indianapolis, Ind.

WANTED

Everyone who has a truck will be interested in our free booklet, "Truck Tire Insurance." It tells how Giant Trip Traction Equipment makes trucks 100% efficient. We want you to write for it today.

CHALLONER COMPANY, Dept. T 19
Oshkosh, Wis.

WANTED

Jaw crusher about 24"x34", for medium soft limestone—30 to 50-ft. elevator. Describe and give price.

Lock Box 6, Bedford, Indiana

What have you to sell? What would you buy?

IN every issue of Rock Products you will find several pages devoted to those who wish to buy and sell used equipment. If you have some equipment to sell you cannot do better—for quick results—than to place an ad in the

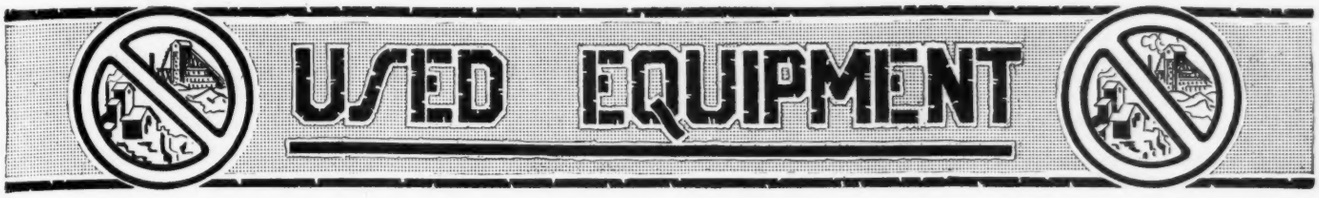
Classified Columns

If you want to buy some used machinery, look in the used-equipment pages for it.

If you do not see what you want, advertise your needs in these columns. The cost is inconsiderable. The results—splendid!

Rock Products

Tradepress Publishing Corporation
542 South Dearborn St., Chicago, Ill.



Repaired Contractors' Equipment

Steam Shovels

Model 60 Marion Shovels, 2½-yard dippers, Nos. 1999, 2059

Locomotives

1—14 x 20″ standard gauge saddle tank Locomotive.
2—American 10 x 16″ Locomotives, 36″ gauge, with butt joint boilers
4—18-ton 10 x 16″ Dinkeys, 36″ gauge
2—12-ton 9 x 14″ Dinkey, 36″ gauge

Cableway

1—Lidgerwood Cableway, 1164-ft. span, with 9 x 10″ DC Reversible Link Motion Cableway Engine, 3-ton capacity

We have a large stock of thoroughly repaired Construction Equipment of all kinds ready for immediate shipment.

Clam Shell Buckets

1—1-yard type "E" Blaw
1—1½-yard Browning.

Cars

20—12-yard Western Air Dump, standard gauge, 26 ft. bed.
25— 4-yard Oliver and K. & J. Wood Beam, 36″ gauge
26—12-yard Western air-dump standard gauge cars, 19′ bed.

Hoisting Engines

1—8½ x 10 DC 2-D Lambert, with boiler
1—6 x 10″ DC 2-D Byers.
1—6¼ x 10 DC 2-D Mundy, with attached swinger and boiler

H. KLEINHANS COMPANY

Union Arcade **Pittsburgh, Pa.**

FOR SALE

36″ gauge steam 18-ton locomotive.
5 Western 4-yd. 36″ gauge cars.
2 Holt caterpillar tractors.
5 all-steel 6-yd reversible trailers.
Byers auto crane, ¾-yd. clam.
Economy excavator, ⅝-yd. (dragline).
Climax geared locomotive, 42″ gauge, 15 ton.
Track scale, 68-ton capacity.

Lock Box 205, Crown Point, Ind.

¶ What you don't want someone else wants. And what you need someone else has to sell.

¶ State your needs or what you have to sell—in these columns. They pay!

STONE CRUSHERS

Need one, large or small? We are headquarters for good "used" machinery of this character. At present our holdings consist of nearly 100 different sizes—Gyratory Crushers from No. 2 to No. 21, Jaw Type from 8x14″ to 60x84″, also several Symons Disc and Crushing Rolls.

Let us know your requirements and you will hear from us by return mail. Inquiries also solicited for:

Locomotive Cranes, Steam Shovels, Locomotives, Cars, Rails, Hoists, Cableways, Compressors, Etc.

Wm. B. Grimshaw Co., 1048 Drexel Bldg., Phila., Pa.

Dealers in USED but NOT ABUSED Machinery

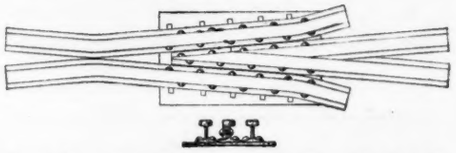
We Design and Equip Complete Plants

for the manufacture of gypsum products, such as wall plaster, moulding plaster, wall board products, gypsum block products, also mixing plants.

We are prepared to furnish complete machinery-equipment and design and furnish plans for the installation. Consult our Engineering Department. Forty years' experience in designing of wall plaster machinery and plants.

The J. B. Ehrsam & Sons Mfg. Co.
Engineers, Machinists and Founders
Enterprise, Kansas

TRACK MATERIAL For QUARRIES, MINES and MILLS



The Central Frog & Switch Co.
Cincinnati, Ohio

Frogs, Switches, Crossings, Switch Stands, Rails, Angle Bars, Fishplates, Throws, Rail Braces, Tie Plates, Portable Track, etc., etc.

SCREENS of All Kinds

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2445 West 24th Place
Tel. Canal 1459 CHICAGO, ILL.

Byers Auto-Cranes
On Broad Road Wheels

John F. Byers Machine Co.
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NNA O.

If you don't find it advertised in Rock Products we will help you get it

Complete Information Service—Just ask us when you desire catalogs or information in a hurry. No charge. For quick action use this form.

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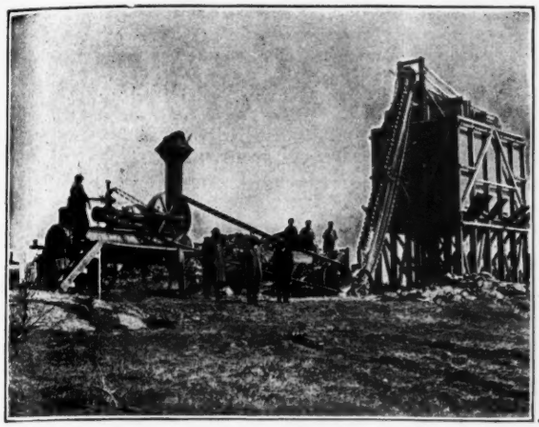
My address is—Street.....City..... State .....

Mail to ROCK PRODUCTS, 542 South Dearborn Street, Chicago, Ill.



COMPLETE INSTALLATIONS
For Stone Quarries or Lime Plants

We are prepared to build and superintend the installation of all equipment necessary to start operations.

Reliance Products are equal to the best and we know that our engineers can save you money by their recommendations. Prompt deliveries.

Let Us Quote You Prices

Universal Road Machinery Co.
Kingston, N. Y.
Reliance Quarry and Road Building Equipment

Toepfer
Quality Perforating
in a large assortment of Dies
Quick Service
Catalog on Request
W. Toepfer & Sons Co.
MILWAUKEE, WIS.
Established 1855

PORTER
Locomotives
For Contractors' Use

Send your locomotive problems to us for solution. Our fifty years of experience will be invaluable to you in selecting the best possible locomotives for your particular line of work.

Our complete catalogue of steam locomotives is free to prospective users.

H.K.PorterCompany,Pittsburgh,Pa.

Audubon Double Crimped Wire Cloth

A uniform product assuring maximum production and uniformity of results.

Wire cloth of iron, steel, brass, galvanized and special metals for every purpose.

Detailed information in catalog Copy on request

Audubon Wire Cloth Co., Inc.,
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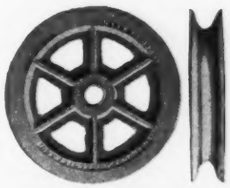
Three miles from Philadelphia



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THE INTERRUPTION
→ INCREASE ←
THE PRODUCTION
of Your Plant By Installing

SUPERIOR NON-ROP-WER SHEAVES

They reduce rope wear to a minimum. Save power and insure safety. *Increases Hoisting Efficiency.* They cost no more than ordinary sheaves. Write for booklet today.

Mayer-Hasseldiek Mfg. Co.
Main, Wash and Commercial Sts. St. Louis, Mo.

BACON-FARREL ORE & ROCK CRUSHING-WORLD KNOWN
ROLLS-CRUSHERS

EARLE C. BACON, INC. ENGINEERS
26 CORTLANDT ST., NEW YORK

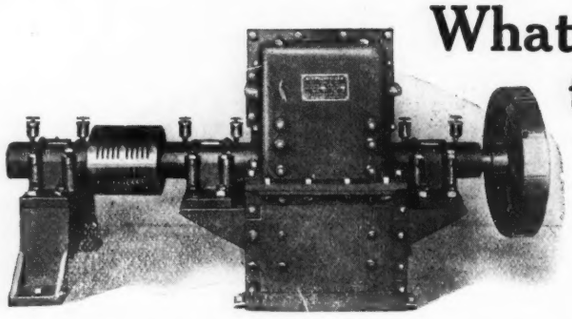
PERFORATED STEEL SCREENS

The success of any house supplying repair and renewal parts depends on furnishing what is needed quickly and correctly, and of satisfactory quality.

Sixteen years in the Perforated Metal field have given us the experience, equipment and technical knowledge, and three hundred tons or more of Steel Plates and Sheets enable us to fill rush orders promptly.

Try us with your next order.

Cross Engineering Company, Offices and Works, Carbondale, Pennsylvania



Whatever you want to crush there's a "K-B" for the Job

Let us tell you what the

K-B PULVERIZER

is doing to solve crushing problems similar to your own. Uses less power and built to last.

Ask us for facts and figures.

K-B PULVERIZER COMPANY, Inc., 92 Lafayette St. NEW YORK

K-B PULVERIZER

BROWNING LOCOMOTIVE CRANES

"The All-Around Champions"

BROWNING "Buckets That Bite"

Both are time and money savers

Write for Catalogs

THE BROWNING CO.
Cleveland, Ohio
Sales Offices:
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WEBSTER

Elevating and Conveying Machinery

For rock, ore, coal and grain handling and for the movement of materials in bulk or packed. Literature and engineering estimates on request.

WEBSTER MFG. CO., Tiffin, Ohio
NEW YORK BOSTON CHICAGO

Planning for the New Year Mr. Lime Manufacturer?

that's the stuff

Going to make some improvements, such as remodeling your old plant or building a new one? That's the thing to do, and right here—Let us assist you by giving you the advantage of our broad experience.

How would you like to operate shaft kilns that produce 20 to 25 tons of lime every 24 hours, EACH? Hardly seems possible, does it? Nevertheless, write us and state your problems and we will gladly explain how you can increase your profits by installing "ARNOLD" Kilns and "ARNOLD" built linings.

Write for our booklet, "The Arnold Lining for Lime Kilns."

ARNOLD & WEIGEL
Contractors and Engineers
WOODVILLE, OHIO

GEAR AND FRICTION DRIVEN GASOLINE LOCOMOTIVES—2½ TO 25 TONS ON DRIVE WHEEL

WHITCOMB LOCOMOTIVES

IT WILL PAY YOU TO GET OUR PROPOSITION BEFORE YOU BUY

GEO. D. WHITCOMB CO.

MAIN OFFICE AND WORKS

ROCHELLE, ILLINOIS
U. S. A.

STORAGE BATTERY LOCOMOTIVES—1 TO 8 TONS ON DRIVE WHEELS

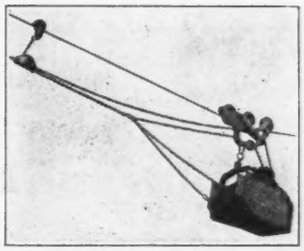
Sauerman Dragline Cableway Excavators

Dig, Convey, Elevate and Dump in One Operation

For certain classes of excavating work, Sauerman Dragline Cableway Excavators have no equal, inasmuch as no other type of machine combines digging, lifting, conveying and dumping in one continuous operation.

These machines are particularly economical and efficient for digging sand and gravel from under water, and are often used instead of pumps. The ability of the dragline cableway excavator to dig over long spans and to great depths has led to the use of our machines for excavating work which steam shovels or boom dragline excavators could not handle without the help of auxiliary conveying equipment.

Sauerman outfits are economical to operate. One man at the levers of a two-drum hoist controls all the operations of digging, conveying, elevating and dumping. After dumping, the bucket returns to the digging point by gravity. Write for further details.



SAUERMAN BROS., 1140 Monadnock Building, Chicago

What Type of Locomotive?

VULCAN LOCOMOTIVES

Are you in doubt of what type of locomotive is best for your work?

Perhaps you have sharp curves and light rail with long trains.

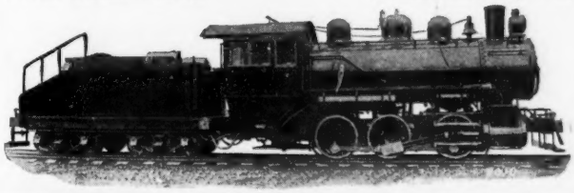
A four wheel switching engine would take the curves, but it is not economical to haul long trains with a four wheel switch over light rail for any great distance.

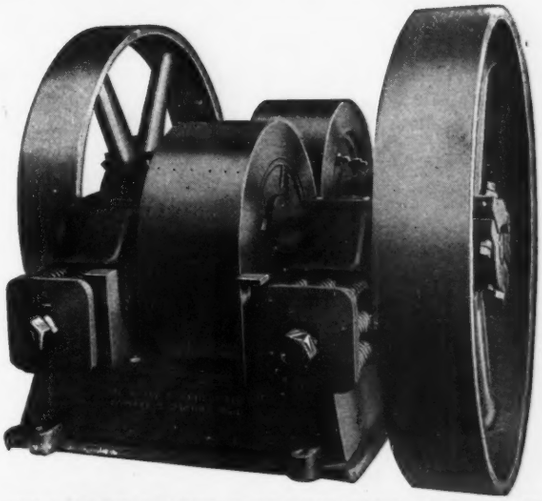
The conditions may be very different from this outline, but if you will submit your problem to us we shall be glad to help find the economical type of locomotive for your work.

VULCAN IRON WORKS

Designers and Builders of Locomotives for 48 Years

1753 Main Street Wilkes-Barre, Pa.



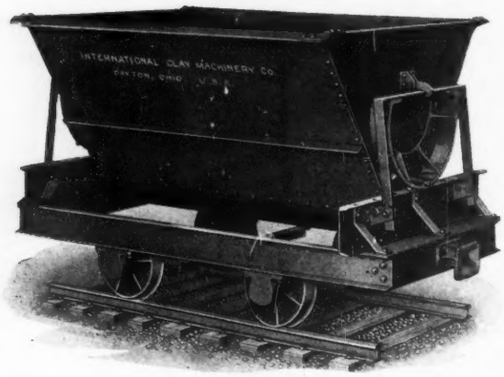


TRANSMISSION EQUIPMENT, SCREENS ELEVATOR BUCKETS, CRUSHERS

Write for descriptive literature

WEBB CITY & CARTERVILLE FOUNDRY & MACHINE WORKS

WEBB CITY, MISSOURI



Industrial Cars

OF ALL TYPES

Portable Trackage

Standard or Built to Your Specifications

International Clay Mach. Co.

1051 Bohlender Ave. Dayton, Ohio

A Highly Efficient Building Material Handler

It's a 20-Ton, 8-Wheel

OHIO CRANE

Serving a Concrete Mixer

Owner, Arthur McMullen, New York City

Outstanding characteristics of the Ohio Crane are: Simplicity of design—few parts—cut steel gears—bronze interchangeable bearings—all parts strong and large—ease and speed of operation.

Ask Us to Show You an Ohio at Work

OHIO LOCOMOTIVE CRANE CO.

S. Sandusky Ave. - - BUCYRUS, OHIO

Universal Crushers

The biggest value for your money. Universal crushers and pulverizers reduce stone to desired size or fineness in a jiffy!

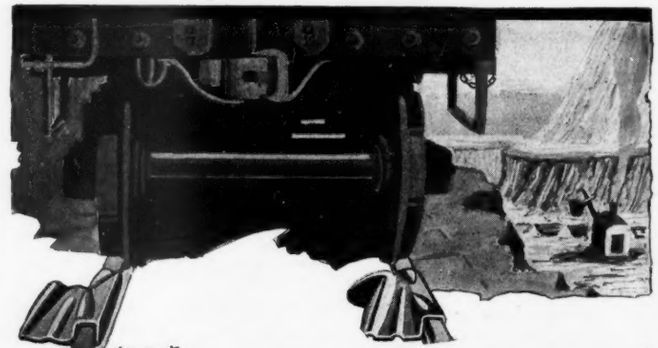
Fifteen years of designing and building experience have made possible the exceptional ability of Universals.

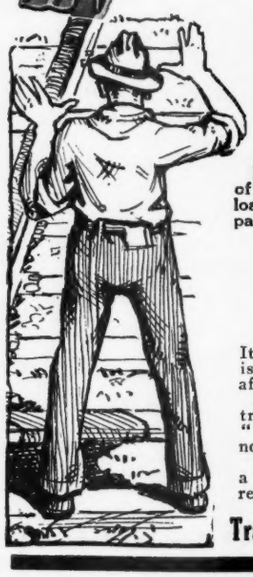
Universal Crusher Co.

225 Third Street

Cedar Rapids, Iowa, U.S.A.

Ask for Folder 1918





Cut the Cost of Replacement Delays!

Figures speak louder than words. All we ask of you is to compare the expense of holding up loading operations to the cost of being prepared for derailments with

FOWLER
Car Replacers

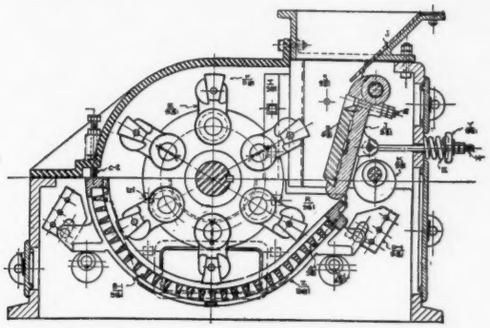
It's plain as "two and tow is four." The cost is so mush less to be prepared that you can't afford to be without a set another day.

Lay Fowler Pressed Steel Replacers on the track. A tug or push on the "drag" and "bingo!" things are moving. No spikes—no time lost.

Send for Fowler descriptive booklets. Orde" a tria! set today. If they fail to suit we will refund purchase price.

Track Equipment Company, Huntington, W. Va.

THE KENNEDY
Swing-Hammer Pulverizer



A Mechanically Perfect Device

The Kennedy Swing-Hammer Pulverizer embodies mechanical improvements heretofore considered unattainable. Reversible, renewable hammer tips and breaker plates of alloy steel. Impact pulverizing—no grinding movement. Adjustable steel grid—so controlled as to permit adjustment while machine is running. Automatic lubrication. Ball and socket bearings—in short, every possible improvement tending toward efficiency, durability and low maintenance expense.

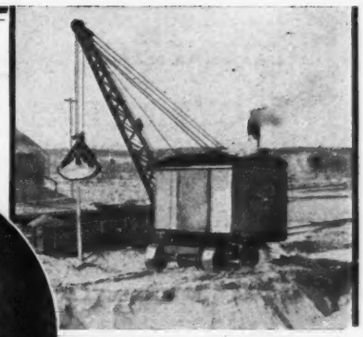
Send for full description

Kennedy Van Saun Mfg. & Eng. Corp.

"Vickers, Ltd., Vickers House, Westminster, London, England, licensed manufacturers for Great Britain and colonies."

120 Broadway **New York**

This ERIE is equipped with a crane boom, and is handling a clam-shell with splendid results. *Owned by HURON SHORE GRAVEL CO., Saginaw, Mich.*



"Our Erie is giving fine service as a crane"

"We have used our ERIE for a year and a half, and we are well pleased with its efficiency and value. With a crane boom and a ¾-yd. clam-shell bucket, the ERIE rapidly digs gravel, strips, and transfers gravel from cars to stock pile and vice versa.

"It is a very useful machine, and has given us the best of service. It has cost us practically nothing for repairs." *John S. Porter, Secy., HURON SHORE GRAVEL CO., Saginaw, Mich.*

Serves as steam-shovel for hard rock or gravel loading.

The ERIE is equally valuable as steam shovel or crane. It is built far stronger than the usual standard; it is RELIABLE. Bulletin P shows what the ERIE can do. Write for a copy.

BALL ENGINE CO., Erie, Pa.
Builders of ERIE Shovels and Cranes; BALL Engines

ERIE Revolving Shovels **BALL Engine Co. Erie, Pa.**

NATIONAL
Screen Separator

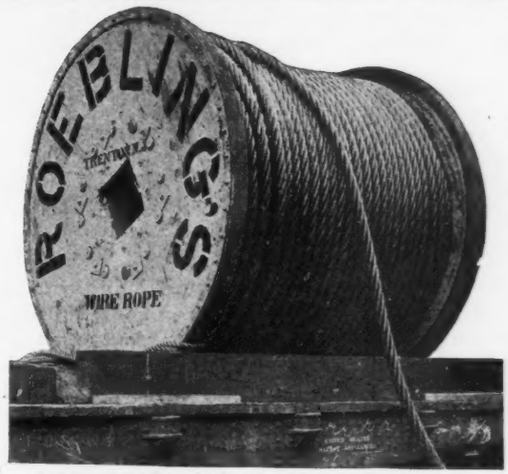
The Leading Screen in

Efficiency
Durability
Simplicity
Capacity

Write for Descriptive Literature to

NATIONAL ENGINEERING COMPANY
549 West Washington Boulevard, Chicago

ROEBLING WIRE ROPE



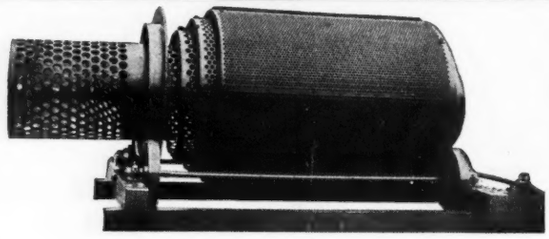
John A. Roebling's Sons Company
TRENTON, N. J.
Branches: New York Boston Chicago Philadelphia Pittsburgh Cleveland Atlanta San Francisco Los Angeles Seattle Portland, Ore.

ROEBLING WIRE ROPE

Stone Screen Sections

CYLINDERS
DUST JACKETS

Made to Fit All Makes and Sizes of Revolving Screens



The O'Laughlin Screen (Patented)

Sand and Gravel Screens

CYLINDERS SCREEN PLATES
CONICAL SCREENS

EVERYTHING IN SCREENS

QUICK SHIPMENTS

Johnston & Chapman Co., 2921 Carroll Ave. CHICAGO

OUR

STANDARD TYPES of Bucket Conveyors

Can be modified to fit your plant and will repay their costs many times in the saving of time and labor. The G-W way of handling Crushed Stone is endorsed by big plant owners and managers all over this country. Our large force of engineers is entirely at your service—right *now* if you're ready. We'll show you *where* you can save—*how much* you can save—and actually *install* G-W Equipment for you.

We Design and Build

- Elevators—Conveyors
- Power Plant Coal Handling Equipment
- Coal Pockets
- Locomotive Coaling Stations
- Wagon Loaders
- Bagging Loaders
- End Thrust and Straight Faced Hoists
- Screens—Chutes
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Hudson, New York

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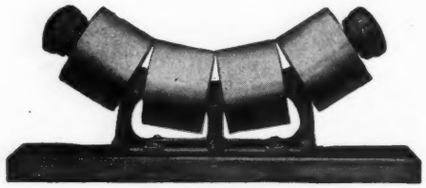

CALDWELL Belt Conveyors

Simple—Economical

will solve your handling problem. Simple in design, economical of power, they give the utmost satisfaction. Our forty years' experience has made us thoroughly familiar with the many details of construction necessary to success.

A rough sketch showing the conditions to be met at your plant will bring our recommendations. We should also know the capacity desired and the power available.

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H. W. Caldwell & Son Co.

Elevating, Conveying and Power Transmitting Machinery

Chicago 17th Street and Western Avenue — 50 Church Street New York, N. Y.

BUCYRUS

It Strips the Overburden and Digs the Limestone

The Atlas Portland Cement Co., Hannibal, Mo., uses this Class-24 Bucyrus Dragline Excavator with a 100-foot boom and a 3½-yard bucket for removing 6 feet of overburden from a cut 10 feet wide. It then digs the blasted limestone.

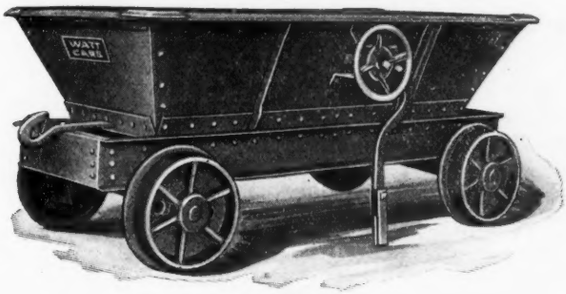
It cuts time and expense of track shifting and saves labor.

Write for Bulletin GP

Dragline excavators of all sizes, revolving and railroad type shovels.

Bucyrus Company, So. Milwaukee, Wis.

New York, Chicago, Birmingham, San Francisco, Portland, Ore., Minneapolis, Denver, Cleveland, Salt Lake City 142



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WATT CARS

In quality of material, in construction and workmanship, Watt Cars are the highest grade, and back of each car is a manufacturing experience of over a half century.

We devote all our time to your requirements.

CARS—That's All We Make—Every Type

The Watt Mining Car Wheel Co.
Barnesville, Ohio

LOCOMOTIVE CRANES
CLAM SHELL BUCKETS - SHIPBUILDING CRANES
CAR DUMPERS PILE DRIVERS
THE McMYLER INTERSTATE CO.
CLEVELAND OHIO

A McMyler Interstate Type "B" Locomotive Crane operating in a sand or gravel pit will handle a maximum amount of material at a minimum cost. That is why this crane represents a profitable investment for sand and gravel dealers. It is not only built for speed, but endurance as well. To learn more about this excellent machine, inquire of

CRANE HEADQUARTERS

The McMyler Interstate Co., Cleveland, O.

BRANCH OFFICES:

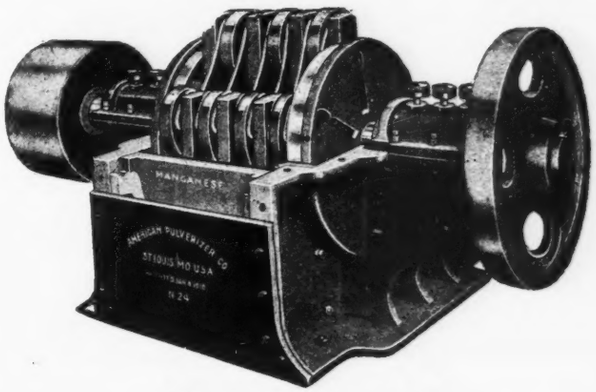
New York	1756 Hudson Terminal Building
San Francisco	Merchants Exchange Building
Seattle	Hoge Building
Denver	18th and Wazee Streets
Chicago	812 Edison Building
New Orleans, La.	Howard Street
Birmingham, Ala.	Brown-Marx Building

The Liberty Bell of this Country

Its buoyant peels rang out, "Speed the production," when war was on.

It still is the most welcome sound to the farmer's ears, because it allows him greater profit on less outlay of money.

His orders are going to **keep coming!** Remember, our army "over there" is now "over here" and our farms must feed them.



The Patented

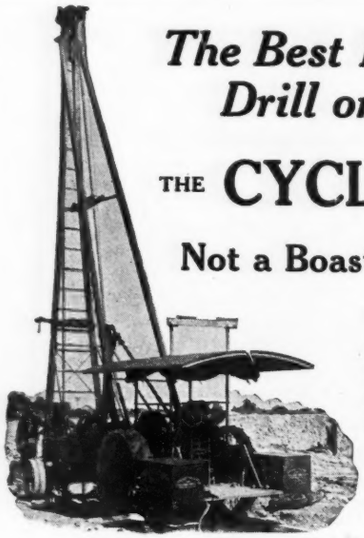
AMERICAN RING PULVERIZER

will show you how to fill this farmer's orders for Lime Stone Fertilizer and make a good profit. This Fall is the time to make known the fact you can make deliveries.

Limestone is a profitable product and it awaits you. An American Ring Pulverizer fills the bill. A simple, efficient, automatic machine—guaranteed to fill your needs at the lowest power consumption.

Write for plans and prices today

American Pulverizer Co.
Cor. 18th and Austin Sts., St. Louis, Mo.



The Best Blast-Hole Drill on Earth

THE **CYCLONE** No. 14

Not a Boast—A FACT

We will prove the superiority of the No. 14 Drill by placing one of the outfits in your quarry against any or all other makes.

If the Cyclone doesn't out-drill and out-wear all other drills, we will remove it from the work without cost to you.

Our proposition gets below the paint—it eliminates talking points and evaporates hot air. It puts buying on a strictly engineering basis where it belongs.

Furnished in Steam, Gasoline, Compressed Air or Electric Power Traction or Non-Traction

Let us send you full particulars

The Sanderson-Cyclone Drill Co.
ORRVILLE, OHIO

Eastern and Export Office, No. 5 Columbus Circle, New York

Note These Please!

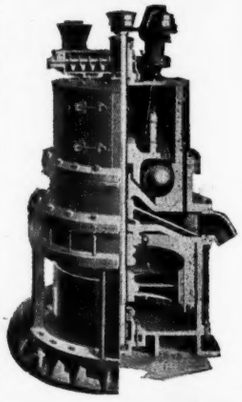
Points of superior merit guarantee economical operation of the Fuller Lehigh

Pulverizer Mill

They are unequalled for producing

Agricultural Limestone

Reduces lump rock to 20, 40, 60, 80, 100 or 200 mesh. Requires no outside accessory equipment. Requires no overhead shafts, drives or screens. All material discharged from mill is finished product. No inside journals or bearings. No inside lubrication. Uniform feeding system. Constant and free discharge. Low installation cost. Low operating cost. Low lubricating cost. Dustless operation. Built in sizes to meet the requirements of your trade. Grinds rock to meet the specifications of all Agricultural Experiment Stations.



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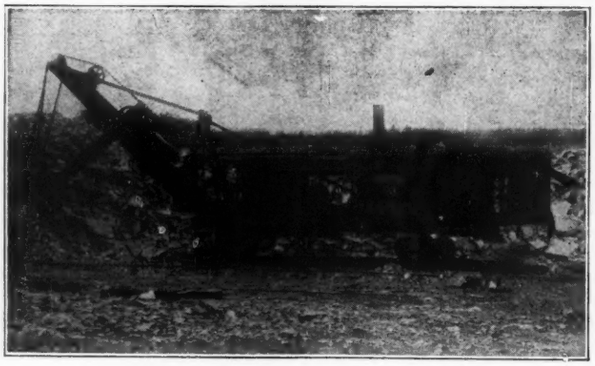


Osgood-73, in Heavy Quarry Work

THE OSGOOD 73—3½ yard steam shovel is designed throughout for the heaviest kind of service. It meets demands where maximum strength is required and severe work to be done, such as found in iron mines, rock works, etc.

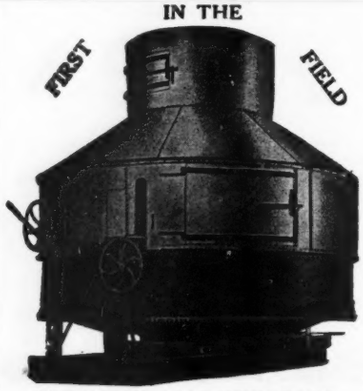
It has all the features in good steam shovel construction which embody steel gears with machine cut teeth; manganese racks and pinions for dipper handle; cast steel swinging circle; heavy front end construction; especially strong boom; large boiler and water tanks; long car frame; enclosed firing platform; steam hoisting friction; by-pass throttle, etc.

We will take pleasure in furnishing you on request complete information on any of the different size shovels we build, which range from ¾ to 6 cubic yard capacity

Write today for copy of our New General Catalog C-1

THE OSGOOD COMPANY, Marion, Ohio

IN THE FIRST FIELD



CLYDE HYDRATOR WITH HOOD
"The common sense way"

THE CLYDE LIME HYDRATOR

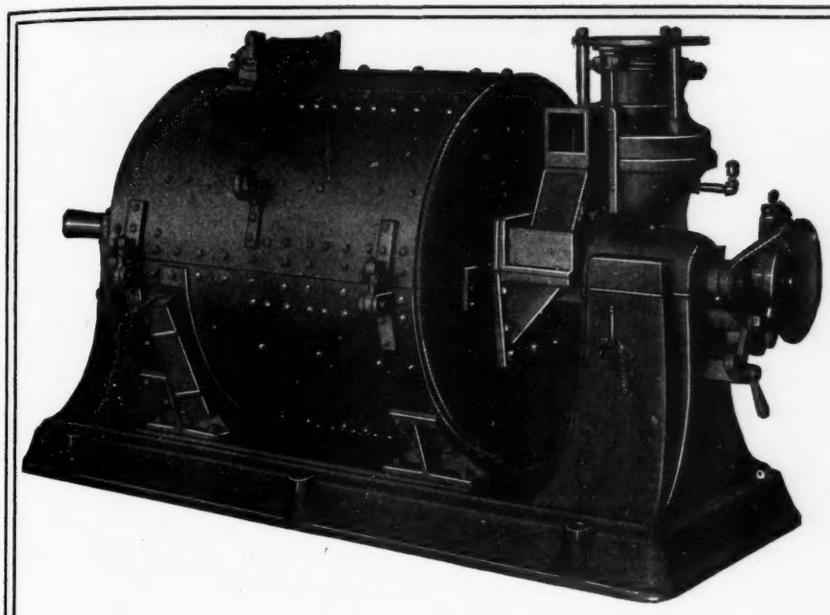
The simplest and easiest to operate. The most economical in Installation, Maintenance and Operation. Makes a **perfect hydrate** of either High Calcium or Dolomite Lime.

Price, per ton capacity, only three-fifths of any other Hydrator on the market.

Write for Catalog and Information

H. MISCAMPBELL, Duluth, Minn.

Patentee and Sole Manufacturer



AERO
PULVERIZERS

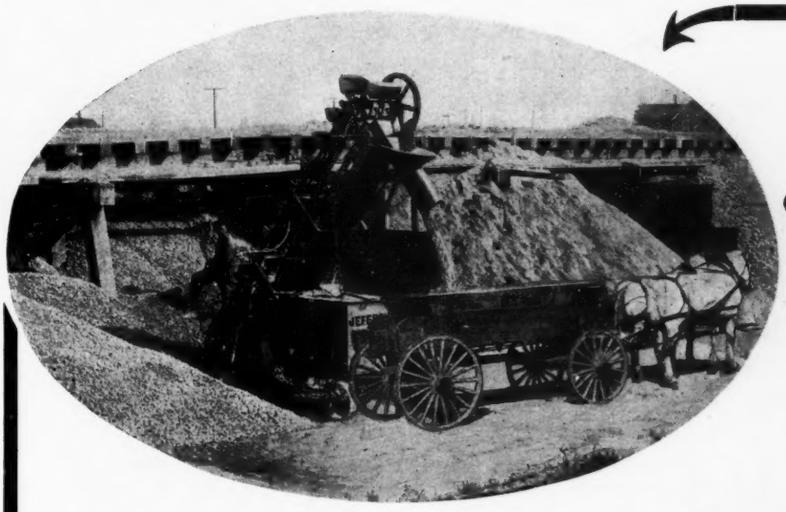
Complete equipment for supplying pulverized coal to metallurgical furnaces, cement and lime kilns, to dryers and to all furnaces requiring a regular temperature and a quality of flame under prompt, easy control.

The AERO makes practicable the highest efficiency obtainable from coal. It makes it burn like a gas, producing at will a wide range of temperatures, a flame, the physical and chemical character of which is regulable — one that may be elongated or shortened, made oxidizing, reducing or neutral, as occasion may require.

Each pulverizer is primarily intended to operate as a unit with a single furnace. The AERO is built in five standard sizes, ranging in capacity from 600 to 5,000 lbs. of coal per hour.

Backed by the Longest Successful Service of Any Pulverized Coal Equipment

The Aero Pulverizer Co., 120 Broadway, New York, N. Y.



THE
Jeffrey
Self-Propelling LOADER

Is Making Over $60.00 a Day for a Prominent Kansas City Sand Company

They state that with their Jeffrey Loader they are loading 1,400 cubic yards of sand daily and after deducting repairs, labor and power, are making over $60.00 a day on the machine.

This is a typical illustration of how the Jeffrey Self-Propelling Loader is saving money for hundreds of Sand and Gravel Dealers, Road Contractors, Retail Coal and Building Supply Dealers, Manufacturers and others.

It will pay you to write for our Catalog No. 177-D, which features a number of interesting installations and gives complete details of the Jeffrey Self-Propelling Loader

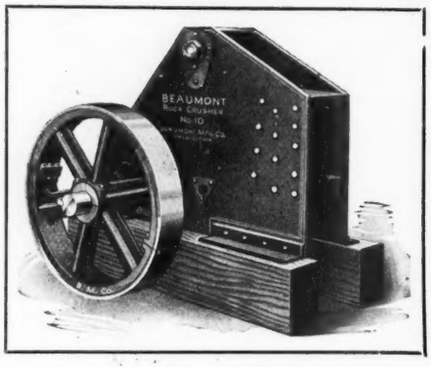
The Jeffrey Mfg. Co., 935 North Fourth St. Columbus, Ohio

BRANCHES: New York, Boston, Philadelphia, Cleveland, Pittsburgh, Chicago, St. Louis, Birmingham, Dallas, Milwaukee, Seattle, Denver, Montreal, Detroit

Manufacturers of Pulverizing, Conveying and Elevating Machinery; Chains; Self-Propelling Loaders; Electric Trolley and Storage Battery Locomotives, etc.

For better service say, "I saw it in ROCK PRODUCTS"

BEAUMONT ROCK CRUSHERS



Rugged

They are built of Plate Steel for heavy service.

A minimum of weight is thus assured with maximum strength. For hard crushing, a Beaumont meets the most exacting demands.

Durable

Wearing Plates are of high carbon steel, bolted on inside of crusher, one on each side of opening, and are reversible four times. Swinging jaw of cast steel weighing approximately 1350 pounds. This jaw has a replaceable bushing on fulcrum shaft.

Simple

Beaumont Crushers are designed mechanically correct, and lost motion is practically eliminated. Few parts as possible insure maximum simplicity of operation. They give the same number of jaw strokes at half the cam shaft speed.

Efficient

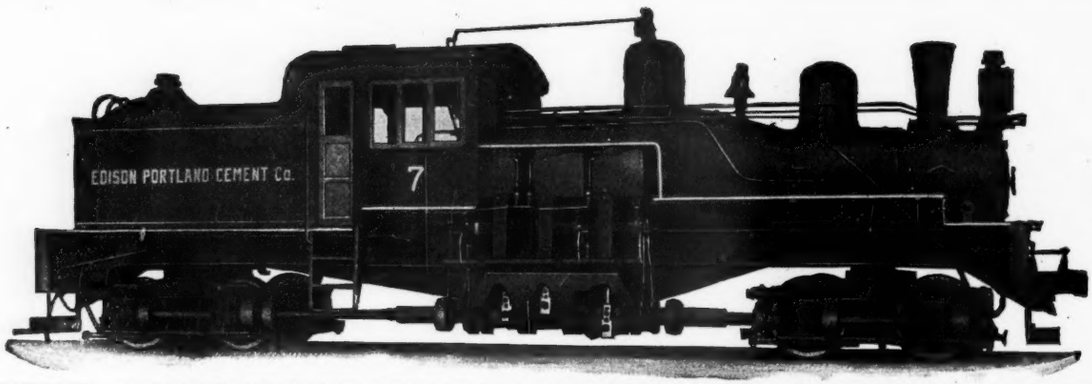
We make no extravagant claim when we say that a Beaumont Crusher will produce as much, and in all probability more stone, size for size, than any other crusher made. Being made of Plate Steel, they weigh less and are ideal Crushers for exporting. The parts are designed so that they can be shipped within customary limitations.

Write for descriptive booklet No. 42 and prices—today!

BEAUMONT MFG. CO., 326 Arch Street, Philadelphia, Pa.

anufacturers of Road Building Machinery, Crushers and Graders

Middle Western Agents: Machinery Sales, Old Colony Bldg., Chicago, Ill. New York: 50 Church St. San Francisco: 461 Market St.



60-TON SHAY ENGINE BUILT BY LIMA FOR EDISON PORTLAND CEMENT CO.

"SHAYS"— FOR QUARRY SERVICE

In quarry and rock crusher service, "Shay" locomotives are far ahead of rod engines.

They have fewer exposed wearing parts that dust and dirt will cut.

They give more continuous service because all wearing parts are easily accessible for replacement.

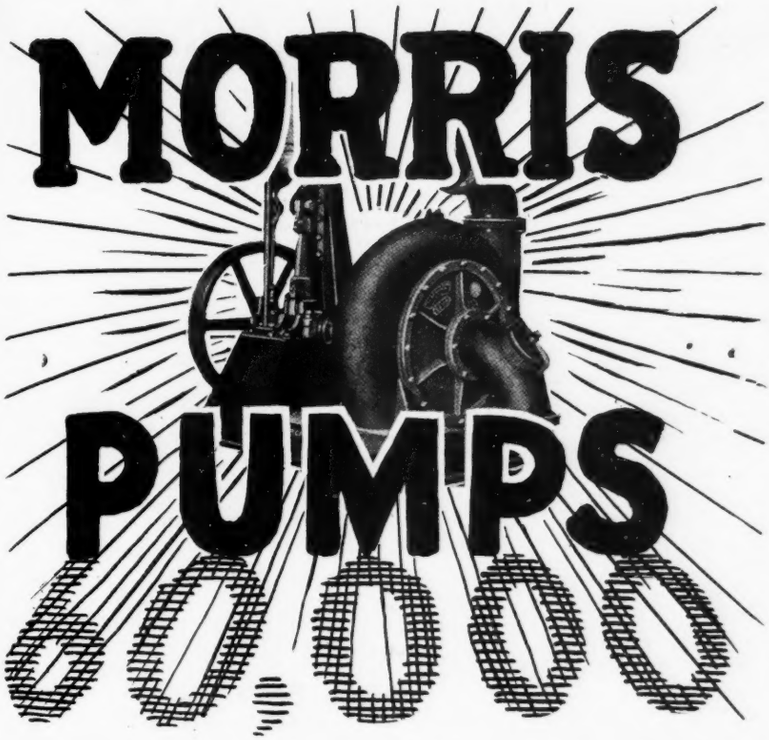
They are cheaper to maintain because you can easily replace any part without dismantling the engine or without special tools.

"Shay" locomotives do more work per day than rod engines can do and cost less to operate and maintain.

LIMA LOCOMOTIVE WORKS, Inc.

LIMA, OHIO **30 Church St., New York**

The advertiser wants to know that you saw his ad in ROCK PRODUCTS



MORRIS PUMPS

and the Morris record of Pump building covering a period since the civil war, throw out some new light on hydraulic and sand pumping.

Their construction meets all requirements, both practical and theoretical.

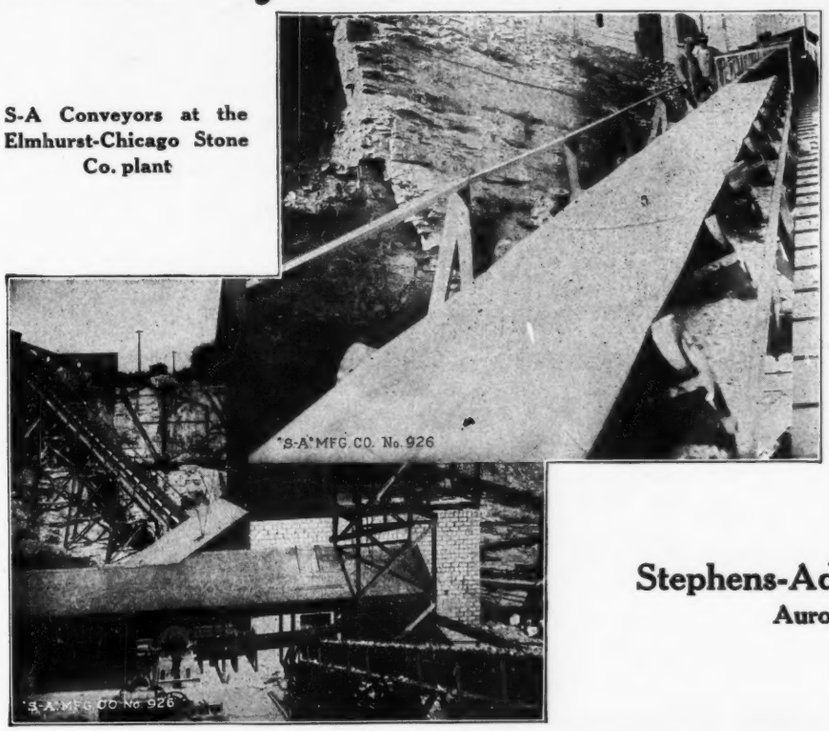
Record in 55 Years

60,000 Morris Pumps. This record we take pride in. Perfect construction and exacting attention in selecting of basic materials have created a demand for Morris Pumps that has necessitated an output of this size.

There is a Morris built for you. Just the right size and capacity. May we figure on your requirements? A copy of our Bulletin 15 on request.

MORRIS MACHINE WORKS, Baldwinsville, N. Y.

Belt Conveyors With Carriers That Last



S-A Conveyors at the Elmhurst-Chicago Stone Co. plant

S-A UNIT CARRIERS are all-steel and therefore they are practically indestructible.

They save power, belt wear and lubrication.

Write for the S-A Sand & Gravel Plant Catalog.

Stephens-Adamson Mfg. Co.
Aurora, Illinois

Buyers' Guide of the Rock Products Industry

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BINS, STORAGE
Weller Mfg. Co., Chicago, Ill.

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Browning Co., Cleveland, Ohio.
Bucyrus Co., The, S. Milwaukee, Wis.
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Link-Belt Co., Chicago, Ill.
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Smith Eng. Works, Milwaukee, Wis.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Sturtevant Mill Co., Boston, Mass.
Universal Road Mach. Co., Kingston, N. Y.
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Gifford-Wood Co., Hudson, N. Y.
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Jeffrey Mfg. Co. The, Columbus, Ohio.
Johnston & Chapman Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.
National Engineering Co., Chicago, Ill.
Smith Eng. Works, Milwaukee, Wis.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Stimpson Equip. Co., Salt Lake City, Utah.
Sturtevant Mill Co., Boston, Mass.
Toepfer & Sons Co., W., Milwaukee, Wis.
Universal Road Mach. Co., Kingston, N. Y.

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Ball Engine Co., Erie, Pa.
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Marion Steam Shovel Co., Marion, Ohio.
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Austin Mfg. Co., Chicago, Ill.
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Weller Mfg. Co., Chicago, Ill.

TRACK EQUIPMENT
Central Switch & Frog Co., Cincinnati, Ohio.

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Goodyear Tire & Rubber Co., Akron, O.
Sullivan Mach. Co., Chicago.

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Smith Eng. Works, Milwaukee, Wis.

WIRE ROPE
American Hoist & Derrick Co., St. Paul, Minn.
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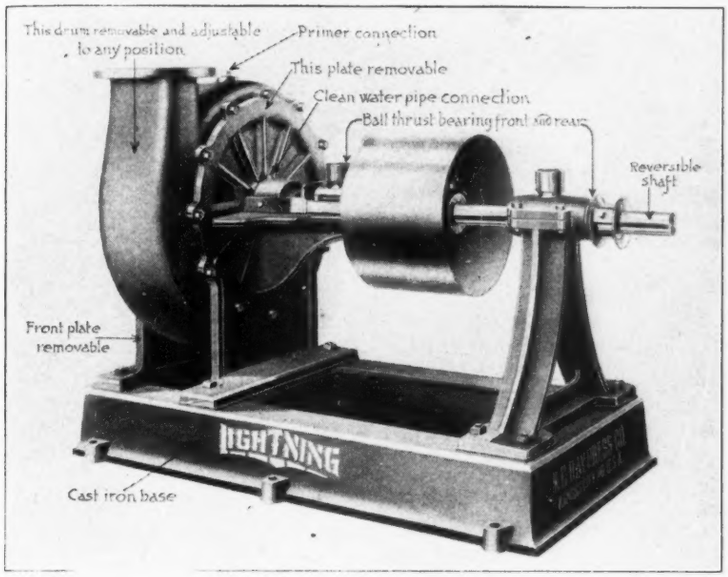

The ideal pump for sand companies and contractors—easy to operate, easy to adjust, easy to replace parts.

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May the spirit of mutual good will and confidence which has existed between us in the past continue and strengthen throughout the New Year and for many years thereafter.

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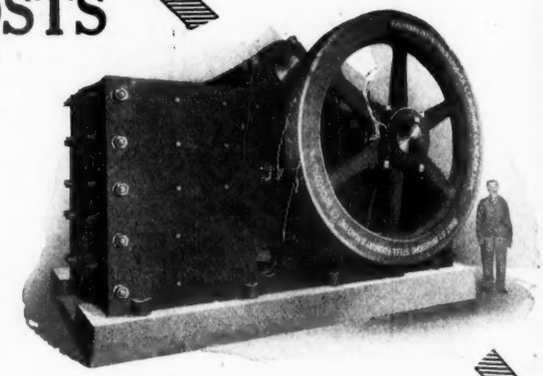
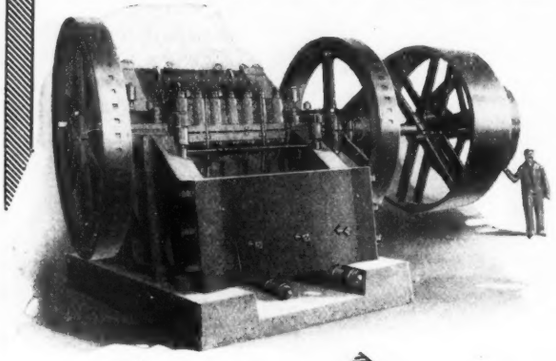
REDUCE CRUSHING COSTS

with a Buchanan. They are simply constructed, yet are massive and rugged. Effect the most dependable efficiency possible and the greatest saving in cost of producing.



BUCHANAN ALL STEEL ROCK and ORE CRUSHERS



The figures show two general designs built for preliminary crushing. Made in standard sizes 60x84", 48x72", 48x60", 42x72", 42x60", and 42x54".

On the hardest rock or ore these machines will make a six-to-one reduction. That is, the size 60x84" will receive rock measuring approximately 60" in thickness and will reduce same to 10" and under, with the usual amount of fine material. The other sizes reduce in the same ratio, according to their respective sizes, and the quality of material.

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Crushing Machinery, Crushing Rolls and Magnetic Separators

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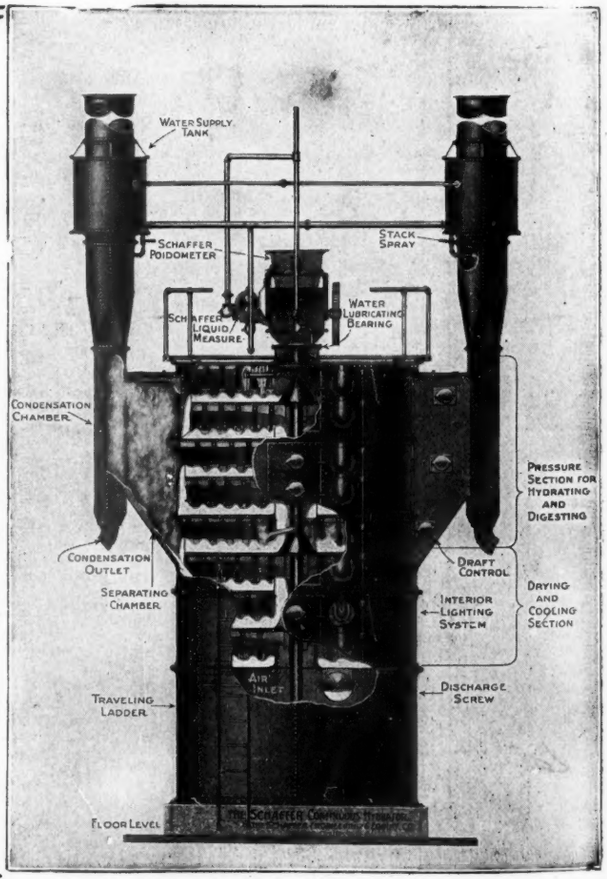
Continuous Lime Hydrators

AUTOMATIC operation delivers lime by **weight,** not volume, to the Schaffer Hydrator. Automatically, water, too, is added in correct proportion—insuring a continuous flow of a superior product.

The flexibility of control enables the use of either high calcium or dolomite lime, while at the same time the automatic operation of Schaffer Hydrators solves the labor problem, as they require but little attention.

Our literature on the Schaffer Hydrator covers all the questions you now have in mind. Write for it at once!



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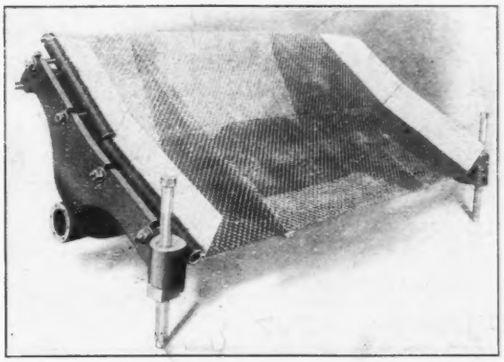
The Mitchell Electric Vibrating Screen

Produce 3,600 vibrations of the screen cloth per minute with no racking or straining



Let a Mitchell screen operate with no material passing over it, and you can hardly tell it is in motion. A slight blur of your vision as you regard the screen cloth, and the soft whirr of the motor in the electric vibrator are the only evidences of activity.

Yet every mesh of the screen cloth is being driven along an upward, circular path at the tremendous rate of 3,600 vibrations a minute.

And in actual operation, the meshes strike the material with an impact of from 500 to 1,000 pounds.

Such power and rapidity in the movement of the screen cloth mean unequalled tonnages screened with unequalled thoroughness. And the entire absence of racking, jarring or straining make for unequalled economy.

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Cut down the labor and time of drilling rock in your road, street or quarry work by ordering one or two

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These ONE-MAN, powerful, handy hammer drills are capable of light or heavy work, and operate on steam or air.

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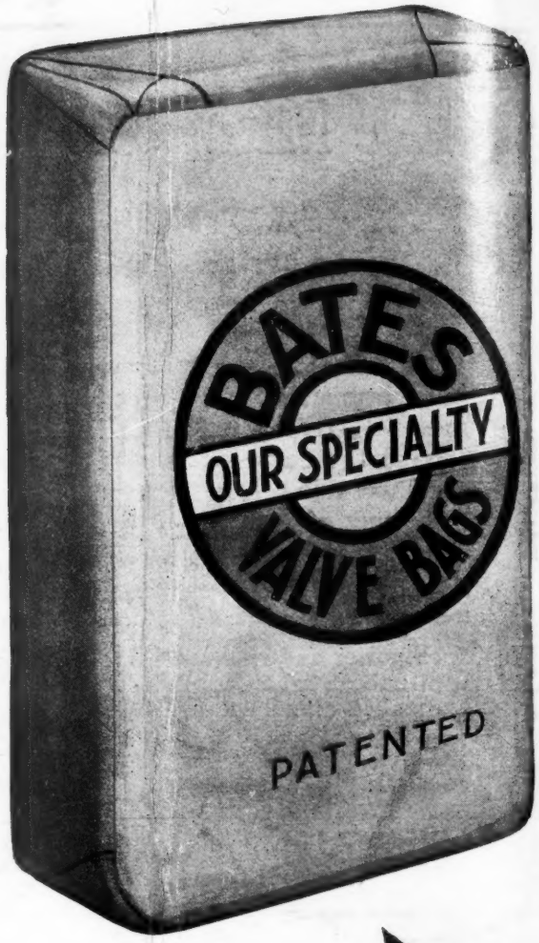
Saying, "I saw it in ROCK PRODUCTS," will bring quick action

"Increasing the Production Was Harder Then Than Now—



—but there wasn't much use in speeding up when it was so difficult and so expensive to take care of the product.

—but now we can take care of the stuff as fast as we can produce it, thanks to the

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and the wonderful self-sealing, bag-filling system." This is a composite remark from hundreds of owners who grew up in the business and who now use the Bates Valve Bag.

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